

Recreational Use Attainability Analysis of Five Creeks along the Little Brazos River: Walnut Creek (1242O), Mud Creek (1242K), Pin Oak Creek (1242L), Spring Creek (1242M), and Campbells Creek (1242I)

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Chapter 1

Introduction

Problem Statement

Walnut Creek (1242O), Mud Creek (1242K), Pin Oak Creek (1242L), Spring Creek (1242M), and Campbells Creek (1242I) are located in the central portion of the Brazos River Basin largely within Roberson County and all flow into the Little Brazos River (Figure 1.1). As of 2006 (TCEQ, 2006), all five water bodies were listed as impaired with regard to bacteria concentrations that exceed state water quality standards for primarily contact recreation. These water bodies continue to be reported as impaired for bacteria and are included in most recent 2012 Texas 303(d) list (TCEQ, 2013).

- Walnut Creek (1242O) is an unclassified water body that extends from the confluence with the Little Brazos River in Robertson County, upstream to the headwaters, one mile south of White Rock. The watershed is contained primarily within Robertson County but also includes portions of Falls County and Limestone County in its headwaters to the north. The City of Bremond is located along the northwest edge of the watershed and is the only municipality within the Walnut Creek watershed boundary. Walnut Creek was first listed as impaired for bacteria in 2006 (TCEQ, 2013). In addition to the bacteria impairment, Walnut Creek has a concern listed for an impaired macrobenthic community (TCEQ, 2013).
- Mud Creek (1242K) is an unclassified water body that extends from its confluence with the Little Brazos River, upstream to the confluence with Touchstone Branch and Wolf Den Branch, in Robertson County. The Mud Creek watershed contains the City of Calvert and much of the City of Franklin and is located entirely in Robertson County. Mud Creek was first listed for bacteria in 2002 (TCEQ, 2013). There are no other impairments or concerns for Mud Creek.
- Pin Oak Creek (1242L) is an unclassified water body that extends from the confluence with the Little Brazos River in Robertson County upstream to the headwaters, 2.07 miles south of Franklin, Texas. No municipalities exist within the Pin Oak Creek watershed, although the City of Hearne is nearby. The Pin Oak Creek watershed is entirely within Robertson County and was first listed for bacteria in 2002 (TCEQ, 2013). There are no other impairments or concerns for Pin Oak Creek.
- Spring Creek (1242M) is an unclassified water body that extends from the confluence with the Little Brazos River in Robertson County, upstream to its headwaters, 1.5 miles north of FM 391. Spring Creek is located entirely within Robertson County and has no municipalities within its watershed boundaries. Spring Creek was first listed as impaired for bacteria in 2002 (TCEQ, 2013). There are no other impairments or concerns for Spring Creek.

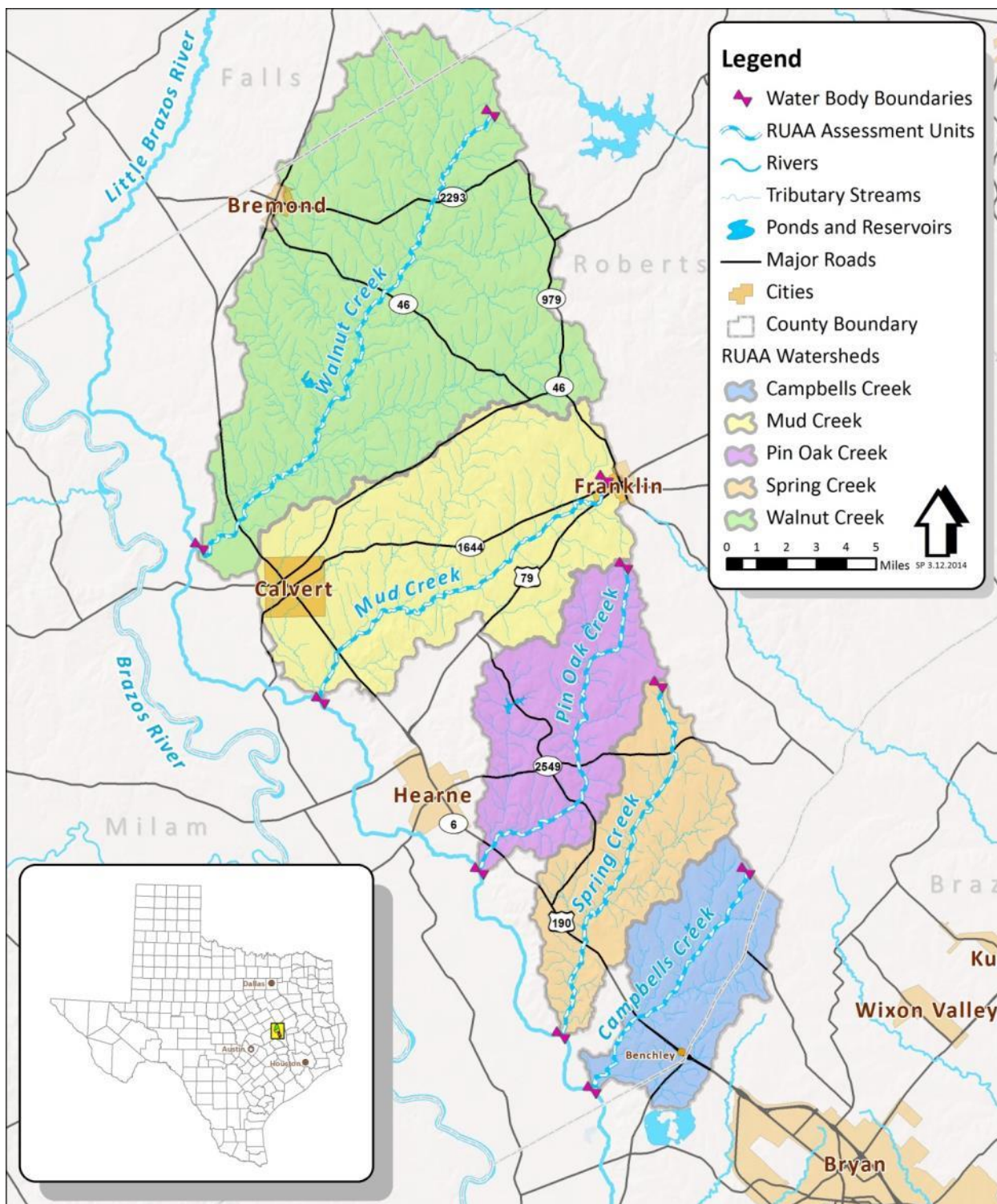


Figure 1.1 Watersheds of Walnut Creek (1242O), Mud Creek (1242K), Pin Oak Creek (1242L), Spring Creek (1242M), and Campbells Creek (1242I).

- Campbells Creek (1242I) is an unclassified water body that extends from the confluence with the Little Brazos River upstream to the headwaters, one mile west of Old San Antonio Road. The Campbells Creek watershed is located largely within Robertson County with its southeastern edge extending into Brazos County. There are no municipalities within the Campbells Creek watershed, although Lake Bryan lies just outside the watershed boundary to the south and extending north from Lake Bryan are some rural subdivisions. Campbells Creek was first listed in 2002 for bacteria and is also listed for concerns for depressed dissolved oxygen(TCEQ, 2013).

These five creeks have a presumed use of primary contact recreation based on the *Texas Surface Water Quality Standards* (TSWQS) (TCEQ, 2010). Prior to June 2010, only two categories of recreation use (contact and noncontact) existed in Texas. In June 2010, the TCEQ adopted revisions to the TSWQS that expanded the designation of contact recreation into three categories based on varying degrees of interaction with the water, while maintaining a fourth category of noncontact recreation. These revisions were codified in the Texas Administrative Code (TAC), Title 30, Chapter 307 and became effective as a state rule on July 22, 2010 (TCEQ, 2010a). As a result of these revisions to the TSWQS, all water bodies listed as impaired for primary contact recreation may undergo a standards review to determine if primary contact recreation is appropriate or if a revision to the use category for recreation should be considered.

Use attainability analyses (UAAs) are studies that evaluate the designated or presumed uses of a water body. To identify and assign attainable uses and criteria to individual water bodies, UAAs evaluate physical, chemical, biological, and economic factors affecting use attainment of a water body (40 Code of Federal Regulations §131.10(g)). A recreational use attainability analysis (RUAA) is a specific type of UAA focused on determining the appropriate recreational use category of a water body, the findings of which are presented within this report for Walnut Creek (1242O), Mud Creek (1242K), Pin Oak Creek (1242L), Spring Creek (1242M), and Campbells Creek (1242I).

Objectives

The objective of this report is to present the findings of a Comprehensive RUAA conducted during the summer of 2010 for these five creeks following the Texas Commission on Environmental Quality (TCEQ) May 2009 *Procedures for a Comprehensive RUAA and a Basic RUAA Survey*. A RUAA consists of three parts: a historical review regarding recreational use of the water body, field surveys documenting water-body characteristics and signs of recreation, and interviews with stakeholders regarding past and current use of the water body. All components of these RUAA's were performed by the Brazos River Authority (BRA) under contract with the Texas State Soil and Water Conservation Board (TSSWCB).

Chapter 2

Study Area

Study Area Description

For this report, the following watersheds (listed north to south) will be collectively referred to as the five tributaries of the Little Brazos River:

- Walnut Creek (1242O),
- Mud Creek (1242K),
- Pin Oak Creek (1242L),
- Spring Creek (1242M), and
- Campbells Creek (1242I).

The five tributary watersheds (Figure 1.1 and Table 2.1) cover an estimated area of 323 square miles (207,300 acres); the majority (94.6%) of which lies in Robertson County. Although these watersheds are largely rural, the City of Bremond is located along the northwest edge of the Walnut Creek watershed, and the City of Franklin lies along the eastern edge and the City of Calvert within the northwest portion of the Mud Creek watershed (Figure 1.1).

Table 2.1 Stream characteristics associated with five tributaries of the Little Brazos River.

Water Body	Assessment Unit	Flow Type ^a	Length of Assessment Unit (miles) ^b	Estimated Watershed Area (acres)
Walnut Creek	1242O	Perennial	24.6	87,600
Mud Creek	1242K	Intermittent with pools	15.4	50,300
Pin Oak Creek	1242L	Intermittent with pools	15.5	26,000
Spring Creek	1242M	Intermittent with pools	16.9	23,200
Campbells Creek	1242I	Intermittent	12.8	20,200

a. Source: 2012 Texas Water Quality Inventory Water Bodies Evaluated (May 9, 2013).

b. Distances were calculated using the snap (editing) tool, followed by the split line at point (data management) tool in ArcInfo 10.0.

For the northernmost creek, Walnut Creek, the flow type as defined by the TCEQ (TWQI, 2012) as perennial. The flow type for Mud Creek, Spring Creek, and Pin Oak Creek is defined as intermittent with pools. The flow type for Campbells Creek, the southernmost creek in the group,

is defined as intermittent. There are no USGS stream gauges along these five creeks, so continuous flow data are unavailable. The presumed aquatic life use is based on the flow type (Table 2.2). Incidental fishing and fish consumption is presumed in all but Campbells Creek.

Table 2.2 Uses associated with the RUAAs water bodies.

Water Body (Assessment Unit)	Aquatic Life Use	Primary Contact Recreation Use	General Use	Fish Consumption Use
Walnut Creek (1242O)	High	X	X	X
Mud Creek (1242K)	Limited	X	X	X
Pin Oak Creek (1242L)	Limited	X	X	X
Spring Creek (1242M)	Limited	X	X	X
Campbells Creek (1242I)	Minimal	X	X	

According to the 2012 Texas Integrated Report (TCEQ), all five creeks are unclassified water bodies. Walnut Creek was first listed in 2006; the remaining four water bodies (Mud Creek, Pin Oak Creek, Spring Creek, and Campbells Creek) were first listed in 2002 (Table 2.3). All five water bodies have continued to be listed on the Texas 303(d) List since first listed for excessive bacteria. In the 2012 Texas Integrated Report, all five water bodies were indicated as not supporting the use of primary contact recreation based on the geometric mean of *E. coli*.

Table 2.3 Assessment information for recreational use associated with five tributaries of the Little Brazos River.

Water Body	Water Body ID	Year First Listed as Impaired for Primary Contact Recreational Use	2012 Inventory # Samples Assessed for <i>E. coli</i> (colonies/ 100mL)	<i>E. coli</i> Geometric Mean 2012 Inventory (colonies/ 100mL)	<i>E. coli</i> Geometric Mean Criteria (colonies/ 100mL)
Walnut Creek	1242O	2006	42	438	126
Mud Creek	1242K	2002	50	687	126
Pin Oak Creek	1242L	2002	45	720	126
Spring Creek	1242M	2002	42	797	126
Campbells Creek	1242I	2002	34	1891	126

- a. Source: 2012 Texas Integrated Report: Assessment Results for Basin 12 - Brazos River. Assessment period December 1, 2003 through November 30, 2010.

The five tributaries of the Little Brazos River all fall within the East Central Texas Plains Ecoregion (Level III), many areas of which have a dense, underlying clay pan affecting water movement and available moisture for plant growth (Griffith et al., 2007). The region was

originally covered with Post Oak Savanna vegetation, but now the much of this region is used for pasture and range for cattle. At a Level IV, the entirety of the four northernmost watersheds are located within the Southern Post Oak Savanna Ecoregion, while the majority of the southernmost watershed (Campbells Creek) is located within the San Antonio Prairie Ecoregion.

Climatic Conditions

Annual precipitation for the area averages about 40 inches based on long-term data for Bremond, Franklin and College Station, Texas (NOAA, 2013). Peak rainfall months tend to be May, June, and October with over four inches on average occurring in each month (Figure 2.1). The lowest rainfall generally occurs in July with only about two inches. Snowfall accumulations are limited (often in tenths of inches) but do occur in the winter months of December, January, and February.

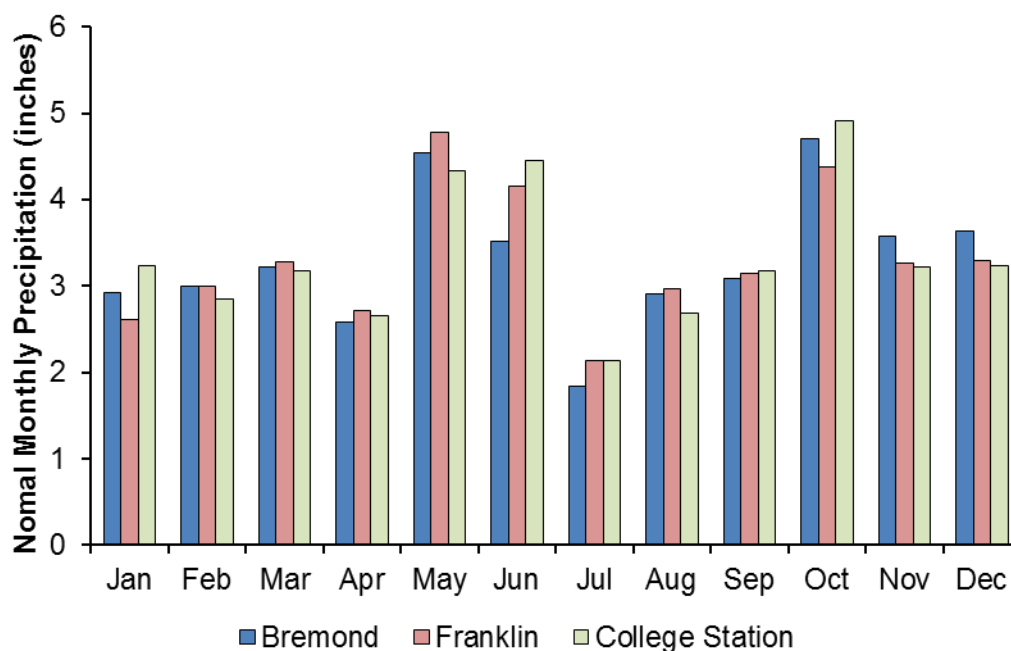


Figure 2.1 Monthly average precipitation for Bremond, Franklin, and College Station, Texas.

Source: NOAA (2013) based on normals for 1981-2010.

With regard to temperatures, average maximum temperatures for Franklin, Texas ascend above 70° F (21° C) beginning in March and continuing through November (Figure 2.2). March through October are the months noted as generally suitable for assessing recreational use, but only if temperatures reach above 70° F (TCEQ, 2009).

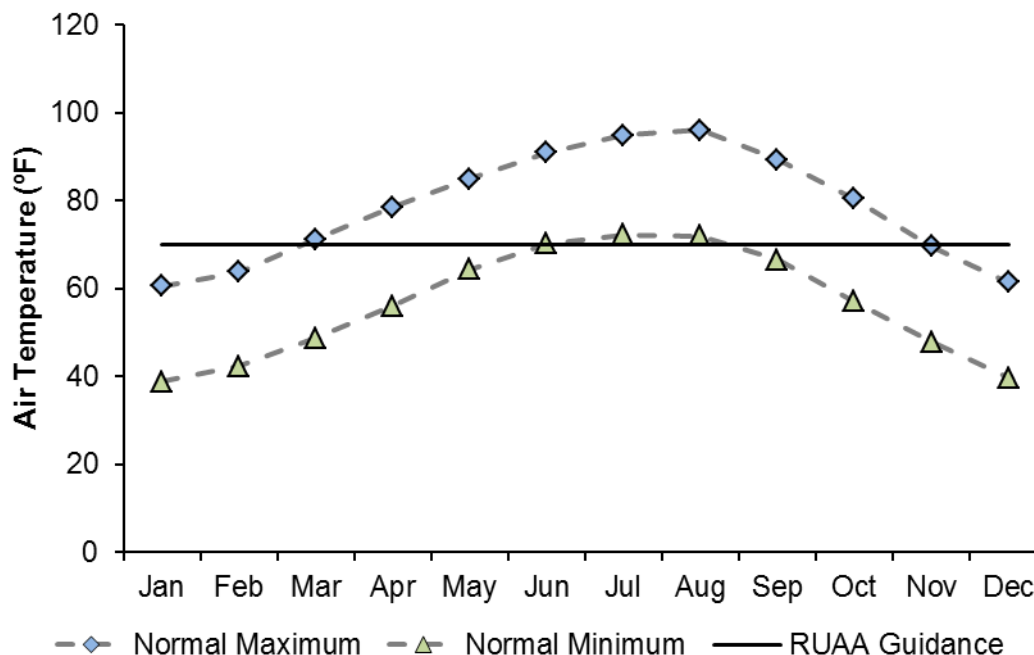


Figure 2.2 Monthly normal maximum and minimum air temperatures for Franklin, Texas compared to RUAAs guidance for field surveys.

Source: NOAA (2013) based on normals for 1981-2010 and TCEQ (2009).

Land Use and Land Cover

The watersheds of the five tributaries of the Little Brazos River are largely rural, with forest and pasture/hay the major land uses (Figure 2.3 and Table 2.4).

The land use/land cover for the area was obtained from the National Land Cover Database (NLCD) maintained by the U.S. Geological Survey (USGS, 2011). While the following 13 NLCD land use/land cover categories occur within these watersheds, the categories of developed, forest, and wetlands were combined for presentation purposes in Figure 2.3 and Table 2.4.

- **Open Water** - areas of open water, generally with less than 25% cover of vegetation or soil.
- **Developed, Open Space** - areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot, single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- **Developed, Low Intensity** - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.

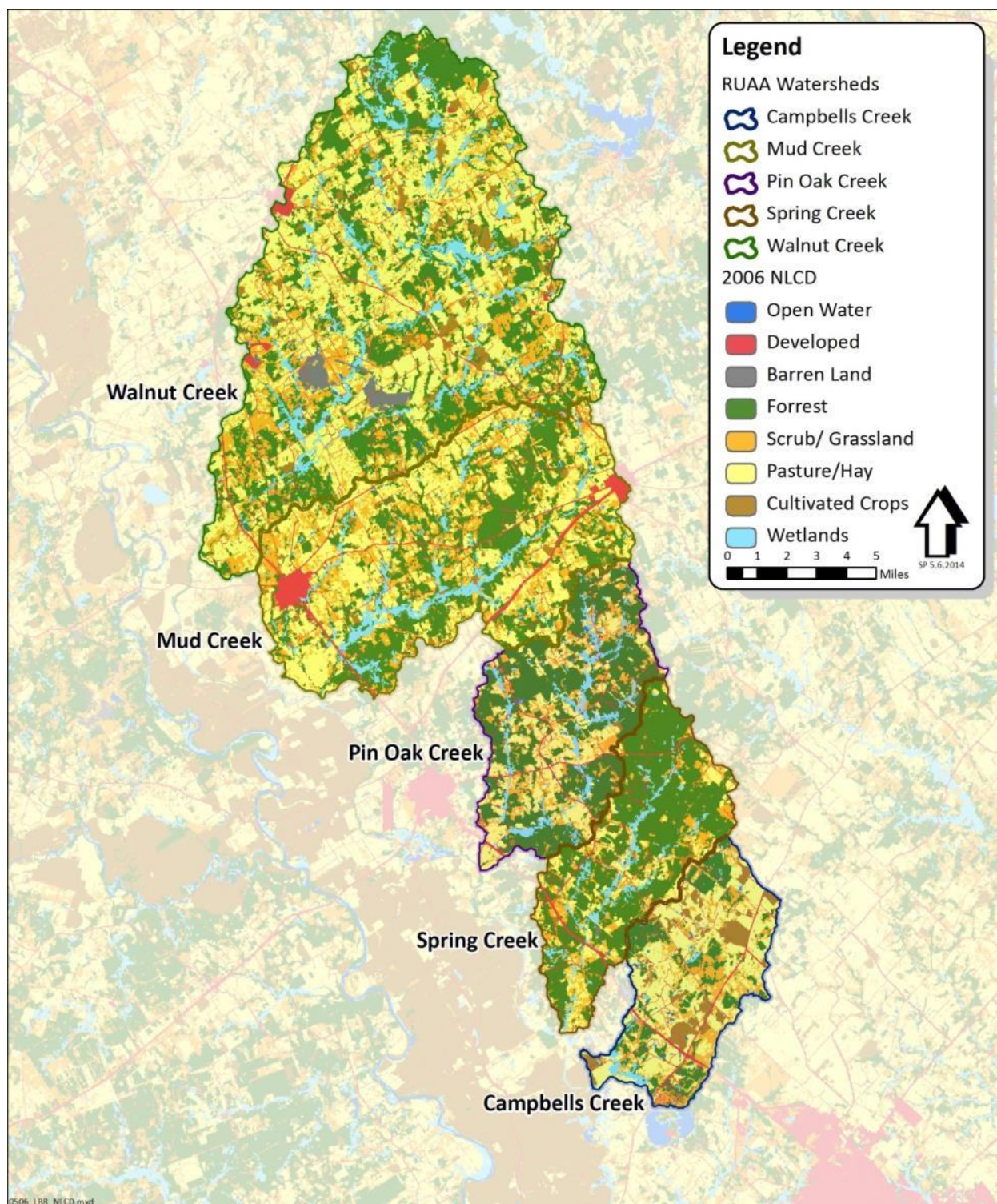


Figure 2.3 Land use/land cover for five tributaries of the Little Brazos River.

Source: 2006 NLDC (USGS, 2011).

Table 2.4 Estimated percent land use/land cover for watersheds of five tributaries to the Little Brazos River.

Source: 2006 NLDC (USGS, 2011).

Land Use/Land Cover	Walnut Creek	Mud Creek	Pin Oak Creek	Spring Creek	Campbells Creek	Total Area
Open Water	0.2%	0.1%	0.2%	0.1%	0.4%	0.2%
Developed	4.4%	6.9%	3.5%	3.9%	5.7%	5.0%
Barren	1.5%	0.0%	0.1%	0.2%	0.1%	0.7%
Forest	29.6%	30.8%	50.6%	61.4%	19.8%	35.1%
Shrub/Scrub	19.2%	21.7%	14.5%	13.7%	21.0%	18.8%
Pasture/Hay	38.2%	34.1%	23.3%	14.5%	50.5%	33.9%
Wetlands	6.8%	6.4%	7.6%	6.2%	2.4%	6.3%

- **Developed, Medium Intensity** – areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.
- **Developed High Intensity** - highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.
- **Deciduous Forest** - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
- **Evergreen Forest** - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.

- **Shrub/Scrub** - areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
- **Grassland/Herbaceous** - areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
- **Pasture/Hay** – areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
- **Cultivated Crops** – areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.
- **Woody Wetlands** - areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- **Emergent Herbaceous Wetlands** - Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Wastewater Discharge Facilities

Based on a review of permitted facilities in conjunction with the TCEQ “Permitted Wastewater Outfalls” coverage (accessed November 2013), there are wastewater outfalls located only within the Walnut Creek, Mud Creek, and Campbell Creek watershed (Table 2.5). No permitted wastewater discharges are located within the Pin Oak or Spring Creek watersheds. Municipal wastewater dischargers include the City of Franklin, the City of Bremond, the City of Calvert, and the City of Bryan. Other permitted wastewater dischargers are associated with mining or power production.

Regulated Stormwater

The Municipal Separate Storm Sewer (MS4) Phase I and II rules require municipalities and certain other entities in urban areas to obtain permits for their stormwater systems. Phase I permits are individual permits for large and medium sized communities with populations exceeding 100,000, whereas Phase II permits are for smaller communities that are located within an “Urbanized Area”. An “Urbanized Area” as defined by the U.S. Census Bureau is an area with populations greater than 50,000 and with an overall population density of at least 1,000 people per square mile. All three cities within these five watersheds have relatively small populations. Population estimates based on the 2010 Census are 929 for the City of Bremond, 1,192 for the City of Calvert, and 1,564 for the City of Franklin (USCB, 2010). Because these cities are not considered urbanized areas, they are not required to obtain stormwater system permits.

Table 2.5 Permitted discharge facilities within watersheds of five tributaries to the Little Brazos River.

Note: There are no permitted discharge facilities in the Pin Oak Creek or Spring Creek watersheds.

Associated Creek	Receiving Water Body	NPDES Permit No. ^a	TPDES Permit No. ^b	Permittee	Facility	Type	Permitted Discharge (MGD)
Walnut	Unnamed tributary to Big Willow Creek hence to Walnut Creek	TX0023442	WQ0010917001	City of Bremond	City of Bremond Wastewater Treatment Facility	wastewater	0.22
Walnut	Thirteen outfalls which discharge to various tributaries and then to Walnut Creek	TX0101567	WQ0002881000	KT Mining Inc.	Calvert Mine (lignite mining facility)	wastewater	variable
Walnut	Three outfalls that discharge to various tributaries to Bee Branch and then to Walnut Creek	TX0101168	WQ0002877000	Optim Energy Twin Oaks, LP	Twin Oaks Power Station	wastewater	variable
Mud	Unnamed tributary of Mud Creek to second unnamed tributary of Mud Creek hence to Mud Creek	TX0021318	WQ0010440001	City of Franklin	City of Franklin Wastewater Treatment Facility	wastewater	0.3

Associated Creek	Receiving Water Body	NPDES Permit No.^a	TPDES Permit No.^b	Permittee	Facility	Type	Permitted Discharge (MGD)
Mud	Tidwell Creek to Sandy Creek hence to Mud Creek	TX0054020	WQ0010095001	City of Calvert	City of Calvert Wastewater Treatment Facility	wastewater	0.25
Campbells	Elm Creek to Peach Creek hence to Campbells Creek	TX0073954	WQ0002117000	City of Bryan	Roland C. Dansby Ses. (electrical utility associated with Lake Bryan)	wastewater	variable

a. NPDES = National Pollutant Discharge Elimination System

b. TPDES = Texas Pollutant Discharge Elimination System

Concentrated Animal Feeding Operations

Based on a query of the TCEQ Central Registry conducted in November 2013, there are currently no permitted concentrated animal feeding operations (CAFOs) located within any of the watersheds of the five tributaries to the Little Brazos River.

Potential Unregulated Sources

Unregulated sources are typically nonpoint source in nature, meaning the pollution originates from multiple diffuse locations and is usually carried to surface waters by rainfall runoff, and the sources are not regulated by permit under the TPDES and NPDES. Potential unregulated sources include wildlife (mammals and birds), large exotics, unmanaged feral animals (e.g., feral hogs), on-site sewage facilities (OSSFs), pets, and livestock. Sources observed during the RUAAs surveys are specifically noted within the results.

Non-Permitted Agricultural Activities

Because over 94 percent of the overall watershed area is within Robertson County and less than 6 percent in other counties (Brazos, Falls, or Limestone), agricultural statistics for Robertson County were reviewed as a representation of agricultural production within these five watersheds. According to the 2007 Census of Agriculture (USDA, 2007) for Robertson County, the top crop items include forage and cotton, while the top livestock inventory items include broilers (and other meat-type chickens; quantity 2,394,913) and layers (161,811). Cattle and calves are then next prominent type of livestock with an inventory number of 97,472 head or an estimated stocking density of about 5 acres per cow. Of note, the watershed area for these five creeks comprises only about 36 percent of Robertson County, so county level statistics provide only a rough estimate of potential agricultural activities within these watersheds. While poultry production is prominent in Robertson County, most of this occurs to the north and east of the project area. Based on a scan of aerial images for poultry houses, only a few poultry operations appear to be associated with the five creeks of the Little Brazos River, and most of these are in the Mud Creek watershed, although at least one appears to be in the Campbells Creek watershed.

Wildlife

Based on estimates from Texas Parks and Wildlife Department (TPWD, 2012) between 2005 and 2012, whitetail deer densities range from 13 to 34 deer per 1,000 acres for Resource Management Unit 19, which covers the project area as largely represented by the Post Oak Savannah Ecoregion. Estimates for other types of wildlife were not readily available.

Feral Hogs

While feral hogs are not natural wildlife, they are an invasive, unmanaged species found throughout Texas that contributes bacteria to streams in a manner similar to native wildlife. Feral hogs are noted for moving in groups along waterways, and particularly in times of drought will congregate near perennial water sources to drink and wallow. Feral hogs are classified by TPWD as unprotected, exotic, non-game animals (Taylor, 2003). Although found throughout much of Texas, there is a scarcity of data on feral hog densities in Texas. Signs of feral hogs were encountered at some of the RUAAs survey sites as noted in the field survey results.

On-Site Sewage Facilities

Septic systems or on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. As a rough estimate, the rural population for Robertson County was estimated by subtracting out the city populations for Bremond (929), Calvert (1,192), Franklin (1,564), and Hearne (4,459) from the overall population estimated for Robertson County (16,622) based on 2010 Census data (USCB, 2010). The rural population of Robertson County was estimated at about 0.017 people per acre or nearly 60 acres/person, assuming 10 percent of the land area is occupied by municipalities. Assuming a density of three people per household, only about 1,000 households are estimated to be on OSSFs throughout these five watersheds. One area where OSSFs are expected to be higher in density is within the southern portion of the Campbell Creek watershed. This area is near Lake Bryan and has several rural subdivisions.

Historical Information on Recreational Use

A review of historical information was performed regarding recreational water uses for the five tributaries of the Little Brazos River. This review considered the time period of November 28, 1975 to the present in accordance with 40 CFR Part 131 (EPA standards regulation). Several broad online searches were performed that covered all of the five RUAA watersheds. These included keyword searches on www.google.com according to names of streams, local municipalities, and Robertson County. A search for scholarly articles using similar keywords was also performed on <http://scholar.google.com/>. The Handbook of Texas Online (<http://www.tshaonline.org/>) was searched using names of streams, municipalities, and Robertson County. Two newspapers, Robertson County News (<http://www.robconews.com/>) and The Eagle (<http://www.theeagle.com/>), provided online article search tools, but nothing relevant was gleaned from these sources. In addition to these general online searches, local government sources specific to each watershed were searched and are listed below. No online searches yielded pertinent information regarding recreational use of the five RUAA streams.

Online Sources

City of Bremond

<http://www.bremondtx.org/index.html>

History of Bremond

<http://www.forttumbleweed.net/bremond.html>

City of Calvert

<http://www.calverttx.com/>

Calvert Featured News

<http://calvertfeaturednews.wordpress.com/>

City of Franklin

<http://cityoffranklintx.com/>

City of Hearne

<http://www.hearnetexas.info/>

City of Bryan

<http://www.bryantx.gov/>

Historical information on the area within the November 28, 1975 to present window was almost nonexistent, thus, relies heavily on personal interviews discussed later in this report. Most historical accounts ended in the 1950s, after which the population of the area progressively declined. None of the information from earlier dates pertained to recreational uses on these actual water bodies, although there was some mention of the use of mineral waters taken from wells.

Chapter 3

Study Methodology

Survey Methodology

The following text provides details of the data collection activities designed to obtain the necessary field-related information for the RUAA's. Sites were chosen in accordance with the *Procedures for a Comprehensive RUAA and a Basic RUAA Survey* (TCEQ, 2009) at locations most likely to promote recreational use on Walnut Creek, Mud Creek, Pin Oak Creek, Spring Creek, and Campbells Creek. Most stations were at road crossings as they are the only points of public access on these water bodies (Figure 3.1). Other stations were selected at distance intervals on private property in an attempt to meet the guidance's criteria of three sites every five miles. Interviews were held with local landowners, government agency officials, and others that were familiar with the area using the interview forms provided with the procedures (TCEQ, 2009).

Sampling Methods

Field Survey Data Collection Activities

As specified in the procedures for a Comprehensive RUAA (TCEQ, 2009), two separate field surveys occurred during the warm season (air temperature greater than or equal to 70°F or 21°C) when human recreational activities were most likely to occur (March - October) for each water body. Rainfall records were recorded 30 days prior to each survey.

Data collection activities for each of the two field surveys included the following activities at each RUAA site:

- Measurement of instantaneous streamflow,
- Measurement of average depth at thalweg (deepest depth),
- Measurement of depths, lengths, and widths of substantial pools,
- Measurement of air and water temperatures,
- Reporting of observational/anecdotal data required on the RUAA field forms, and
- Photographing any signs of recreation and site conditions including upstream, downstream, left bank, and right bank photos at the 30-m, 150-m, and 300-m transects.

Instantaneous Streamflow

An instantaneous water velocity measurement was made at each station using the most applicable current meter. Streamflow measurements were made under wadeable conditions and followed protocols outlined in the *TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment and Tissues* (2008).

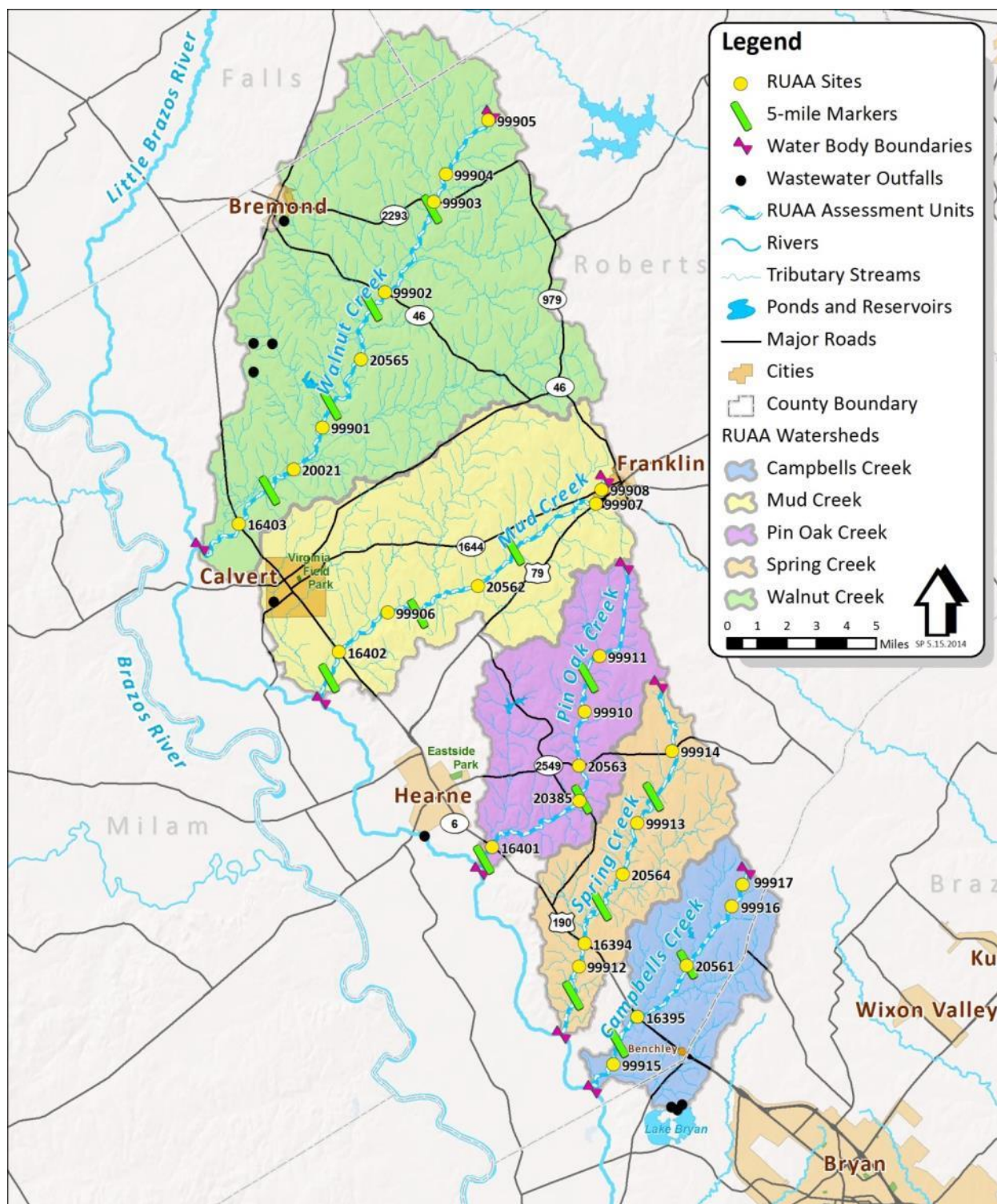


Figure 3.1 Location of RUAA sampling sites within five tributaries of the Little Brazos River.

Average Depth at Thalweg and Substantial Pool Depths

Determination of thalweg and substantial pool depths is applicable to contact recreation use determination for intermittent and perennial freshwaters according to TCEQ (2009). The thalweg is defined as the deepest depth of a transect perpendicular to the stream channel. A substantial pool was defined as a pool greater than 1-m (3.28-ft) deep and 10-m (32.8-ft) long for the purposes of a RUAA Survey (TCEQ, 2009).

As instructed in the RUAA procedures manual (TCEQ, 2009), a 300-m reach at each station was evaluated to determine average thalweg depth. Ten transects at 30-m intervals were established in the 300-m stream reach bracketing each station. All transect distances including thalweg depths and pool depths and lengths are presented in units of meters per the RUAA procedures (TCEQ, 2009).

Observational /Anecdotal Data

Anecdotal information was recorded on field data sheets during all surveys using the field data sheets provided in the RUAA guidance (TCEQ, 2009).

Types of observational and anecdotal records included, but were not limited to, the following:

- Channel flow status
- Stream type (e.g., ephemeral, intermittent, etc.)
- Streamflow
- General weather conditions (cloud cover/rain), including 30-day conditions and antecedent rainfall record
- Substrate type
- Stream accessibility
- Anecdotal information related to observed human contact activities

Air and Water Temperature Measurements

Water and air temperature were reported in degrees Celsius.

Photographs

A photographic record of each site was created during each survey. Photographs included an upstream view, left and right bank views, downstream view (as described in the Field Data Sheets), and any evidence of observed uses or indications of human use, hydrologic modifications, etc. Photographs were intended to clearly depict the entire channel and were taken specifically at the 30-m, 150-m, and 300-m transects for the reach. Photographs were used to document evidence of recreational use (e.g., fishing tackle) and actual recreation. Photographs were also used to document a lack of use (e.g., dry creek beds) or impediments to recreational use. In addition, photographs were also taken to indicate potential bacteria sources to the water body. All photographs were labeled in a manner that indicated the photo's site, location, date, and orientation to the stream. Photos representative of each RUAA field site are included with the survey results for each water body in this report.

Chapter 4

Walnut Creek (1242O)

Survey Site Descriptions

Eight sampling stations were established along Walnut Creek (1242O) for the RUAA field survey (Figure 4.1 and Table 4.1). Seven sites were chosen at public road crossings that did not require permission for access to the creek, but did require landowner cooperation to conduct the full 300 meter assessment. It should be noted that at these seven publically accessible locations, there was actually very limited public access due to property fences and dense vegetation. The remaining two privately controlled sites were selected to provide physical characterization of Walnut Creek in areas between public access points. Entrances to sites on private lands were limited by fences, cattle guards, and/or gates and were often several miles from the stream. RUAA surveys were performed in June and August of 2010 at these locations. A brief description of each site follows.

Site 16403 is located on Walnut Creek at the bridge crossing on State Highway 6, approximately 2.25 miles northwest of Calvert, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242O.

Site 20021 is located on Walnut Creek at the bridge crossing on County Road (CR) 123, approximately 3.5 miles north of Calvert, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242O.

Site 99901 is located on Walnut Creek on private property approximately 5 miles northeast of Calvert, Texas. Site 99901 was only accessible through fenced private property. The site was selected to provide opportunity for characterization of water body 1242O.

Site 20565 is located on Walnut Creek at the bridge crossing on Nesbit Road, just above the Walnut Creek mining area, and approximately 8 miles northeast of Calvert, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242O.

Site 99902 is located on Walnut Creek at the bridge crossing Farm-to-Market Road (FM) 46, approximately 10.2 miles northwest of Franklin, Texas and approximately 10.4 miles northeast of Calvert, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242O.

Site 99903 is located on Walnut Creek at the bridge crossing FM 2293, approximately 5.3 miles east of Bremond, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242O.

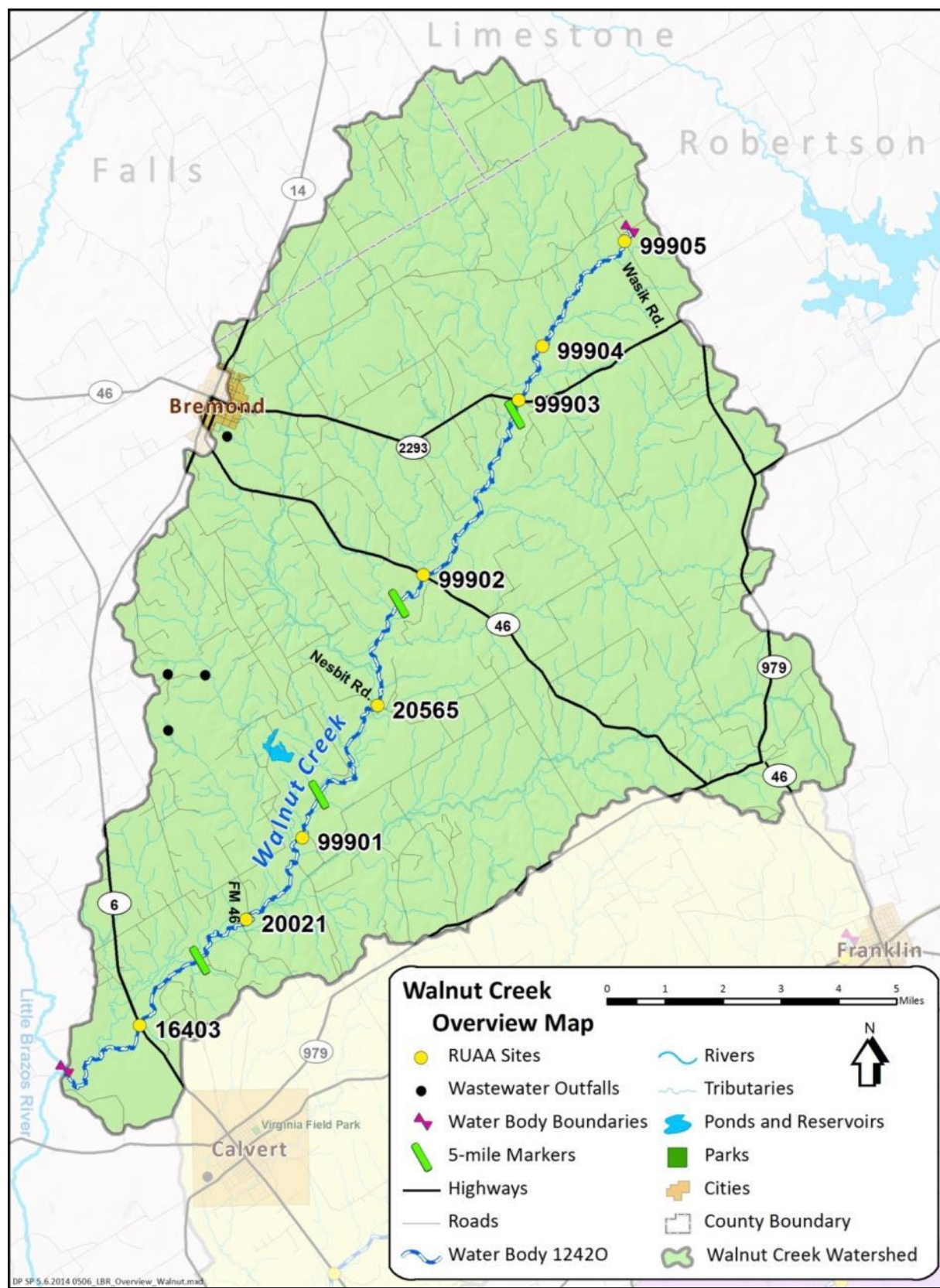


Figure 4.1 Overview of Walnut Creek watershed and RUAA sites for water body 12420.

Table 4.1 Description and location of RUAA field survey sites for Walnut Creek (1242O).

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

Site ID ^a	Site Description	Latitude	Longitude	Distance from Previous Site (miles) ^b	Access
16403	Walnut Creek at State Highway 6	31.0102	-96.7025	2.76 (distance to outlet)	Public*
20021	Walnut Creek at Robertson CR 123 / Sunnyside Road	31.0362	-96.6708	3.37	Public*
99901	Walnut Creek on private property about 0.5 miles east of S. Tidwell Prairie Road	31.0564	-96.6540	2.52	Private
20565	Walnut Creek at Tidwell Road- Nesbit Road	31.0891	-96.6313	3.65	Public*
99902	Walnut Creek at FM 46 southeast of Bremond	31.1216	-96.6171	3.16	Public*
99903	Walnut Creek at FM 2293 southeast of Bremond	31.1650	-96.5882	4.42	Public*
99904	Walnut Creek on private property about a mile north of FM 2293	31.1783	-96.5810	1.41	Private
99905	Walnut Creek at Wasik Rd (CR 448)	31.2042	-96.5563	3.03 ^c	Public*

- When applicable, TCEQ station identification numbers were used for RUAA site IDs. Sites with identification numbers starting with 999 were sites without recognized TCEQ station identification numbers and are specific to this project.
- Distances were calculated using the snap (editing) tool, followed by the split line at point (data management) tool in ArcInfo 10.0.
- Distance from most upstream site to beginning of assessment unit is 0.27 miles.

Site 99904 is located on Walnut Creek approximately 5.8 miles northeast Bremond, Texas. Site 99904 was only accessible through fenced private property. The site was selected to provide opportunity for characterization of water body 1242O. Of note, while included as a RUAA field survey site, access to this location could not be obtained when the surveys were conducted, thus, there are no field survey data for this location.

Site 99905 is located on Walnut Creek at the culvert crossing on Wasik Road, approximately 7.7 miles northeast of Bremond, Texas. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0299A.

Field Survey Results

General Description of RUAA Survey Sites and Conditions

The Walnut Creek RUAA surveys were conducted in June and August, 2010 (Tables 4.2 and 4.3). Air and water temperatures during both the first and second surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 4.2 and 4.3). Precipitation records for the 30 days prior to each survey are shown in Tables 4.4 and 4.5. The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions during both the June and August 2010 surveys (NCDC, 2014).

A summary of the RUAA field survey results is presented in the following tables:

- Table 4.6 describes the stream channel and corridor characteristics at each site.
- Table 4.7 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 4.8 and 4.9 document the maximum, minimum, and average stream widths at each site for each survey as well as the flow and observed flow conditions.
- Tables 4.10 and 4.11 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each site and survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall thalweg depth averaged 0.29 m during the first survey and 0.25 m during the second survey. Access to the stream down the bank was moderately easy to easy at most locations due to low banks and grassy vegetation. The dominant substrate was sand with some locations of mud/clay. The stream corridor was largely lined with forest and pasture with occasional shrubs. The maximum stream width encountered was 15 m during the first survey in June 2010 and 12 m during the second survey in August 2010. Flow conditions were largely normal during both surveys at the three sites below the mine property discharge into Walnut Creek. Sites above where the mine discharge entered Walnut Creek were generally pooled or dry during both surveys. The water surface was either brown or clear in color. Tracks observed most often included cattle, raccoon, and hogs. Trash was rarely observed at most survey sites and when observed was predominantly typical plastics and aluminum cans with occasional appliances or tires. No recreation was directly observed during either field surveys and signs of potential recreation were observed at only a couple of sites.

Table 4.2 Air and water temperatures for each site during the first RUAA survey on Walnut Creek.

Site	Date	Air Temp (°C)	Water Temp (°C)
16403	10Aug10	37.2	28.1
20021	22Jun10	34.4	27.8
99901	10Aug10	33.3	25.6
20565	22Jun10	33.3	27.2
99902	24Jun10	31.4	27.6
99903	22Jun10	29.4	Not measured, no flow
99904 ^a	22Jun10	Not surveyed	Not surveyed
99905	22Jun10	26.7	Not measured, no flow

a. Access to Site 99904 was not available when the RUAA surveys were conducted.

Table 4.3 Air and water temperatures for each site during the second RUAA survey on Walnut Creek.

Site	Date	Air Temp (C°)	Water Temp (C°)
16403	16Aug10	32.2	27.9
20021	16Aug10	29.4	27.5
99901	23Aug10	29.4	25.2
20565	16Aug10	26.7	26.3
99902	13Aug10	33.3	Not measured, no flow
99903	13Aug10	31.7	Not measured, no flow
99904 ^a	13Aug10	Not surveyed	Not surveyed
99905	13Aug10	29.4	Not measured, dry

a. Access to Site 99904 was not available when the RUAA surveys were conducted.

Table 4.4 Rainfall records 30 days prior to the first RUAA survey on Walnut Creek.

Survey dates vary by site with the earliest initiated on June 22, 2010. Days of surveys are highlighted in gray.

Date	Franklin TX US GHCND:USC00413321 (in.)	Bremond TX US GHCND:USC00411045 (in.)
22May10	0.00	0.00
23May10	0.00	0.00
24May10	0.00	0.00
25May10	0.00	0.00
26May10	0.00	0.00
27May10	0.00	0.00
28May10	0.00	0.00
29May10	0.00	0.00
30May10	0.00	0.00
31May10	0.00	0.00
01Jun10	0.00	0.00
02Jun10	0.00	0.00
03Jun10	1.25	1.47
04Jun10	1.30	1.10
05Jun10	0.00	0.00
06Jun10	0.00	0.00
07Jun10	0.00	0.00
08Jun10	0.00	0.00
09Jun10	1.16	0.17
10Jun10	0.84	2.00
11Jun10	0.00	0.00
12Jun10	0.00	0.00
13Jun10	0.00	0.00
14Jun10	0.00	0.00
15Jun10	0.00	0.00
16Jun10	0.00	0.00
17Jun10	0.00	0.00
18Jun10	0.00	0.00
19Jun10	0.00	0.00
20Jun10	0.00	0.00
21Jun10	0.00	0.00
22Jun10	0.00	0.00
23Jun10	0.01	0.00
24Jun10	0.00	0.00

Date	Franklin TX US GHCND:USC00413321 (in.)	Bremond TX US GHCND:USC00411045 (in.)
25Jun10	0.00	0.75
26Jun10	0.00	0.00
27Jun10	0.00	0.00
28Jun10	0.00	0.00
29Jun10	0.00	0.00
30Jun10	0.64	0.02
01Jul10	0.00	0.08
02Jul10	0.00	0.31
03Jul10	0.00	0.59
04Jul10	0.64	0.00
05Jul10	0.00	0.00
06Jul10	0.00	0.00
07Jul10	0.00	0.00
08Jul10	0.00	0.00
09Jul10	0.95	0.27
10Jul10	0.00	0.00
11Jul10	0.00	0.00
12Jul10	0.00	0.00
13Jul10	0.00	0.00
14Jul10	0.00	0.00
15Jul10	0.00	0.00
16Jul10	0.00	0.00
17Jul10	0.00	0.00
18Jul10	0.00	0.00
19Jul10	0.00	0.13
20Jul10	0.01	0.00
21Jul10	0.00	0.00
22Jul10	0.00	0.00
23Jul10	0.00	0.00
24Jul10	0.00	0.00
25Jul10	0.26	0.00
26Jul10	0.00	0.00
27Jul10	0.00	2.41
28Jul10	0.00	0.14
29Jul10	0.00	0.10
30Jul10	0.03	0.00
31Jul10	0.00	0.00
01Aug10	1.86	0.00

Date	Franklin TX US GHCND:USC00413321 (in.)	Bremond TX US GHCND:USC00411045 (in.)
02Aug10	0.81	0.00
03Aug10	0.00	0.00
04Aug10	0.00	0.00
05Aug10	0.00	0.00
06Aug10	0.00	0.00
07Aug10	0.00	0.00
08Aug10	0.00	0.00
09Aug10	0.00	0.00
10Aug10	0.00	0.00

Table 4.5 Rainfall records 30 days prior to the second RUAA survey on Walnut Creek.

Survey dates vary by site with the earliest initiated on August 13, 2010. Days of surveys are highlighted in gray.

Date	Franklin TX US GHCND:USC00413321 (in.)	Bremond TX US GHCND:USC00411045 (in.)
13Jul10	0.00	0.00
14Jul10	0.00	0.00
15Jul10	0.00	0.00
16Jul10	0.01	0.00
17Jul10	0.00	0.00
18Jul10	0.00	0.00
19Jul10	0.00	0.13
20Jul10	0.00	0.00
21Jul10	0.26	0.00
22Jul10	0.00	0.00
23Jul10	0.00	0.00
24Jul10	0.00	0.00
25Jul10	0.00	0.00
26Jul10	0.03	0.00
27Jul10	0.00	2.41
28Jul10	1.86	0.14
29Jul10	0.81	0.10
30Jul10	0.00	0.00
31Jul10	0.00	0.00
01Aug10	0.00	0.00
02Aug10	0.00	0.00

Date	Franklin TX US GHCND:USC00413321 (in.)	Bremond TX US GHCND:USC00411045 (in.)
03Aug10	0.00	0.00
04Aug10	0.00	0.00
05Aug10	0.00	0.00
06Aug10	0.00	0.00
07Aug10	0.00	0.00
08Aug10	0.00	0.00
09Aug10	0.00	0.00
10Aug10	0.00	0.00
11Aug10	0.00	0.00
12Aug10	0.00	0.40
13Aug10	0.00	0.00
14Aug10	0.00	0.00
15Aug10	0.00	0.00
16Aug10	0.00	0.00
17Aug10	0.31	0.00
18Aug10	0.00	0.00
19Aug10	0.03	0.00
20Aug10	0.00	0.00
21Aug10	0.00	0.00
22Aug10	0.00	0.00
23Aug10	0.00	0.00

Table 4.6 Stream Channel and corridor appearance for each site sampled along Walnut Creek (1242O).

Site	Stream Channel Appearance	Dominant Substrate	Corridor Appearance
16403	Natural	Sand	Pasture
20021	Natural	Sand	Forest
99901	Natural	Sand & Mud/Clay	Pasture
20565	Natural	Sand	Pasture & Forest
99902	Natural	Sand & Mud/Clay	Pasture & Shrub
99903	Natural	Sand	Pasture
99904 ^a	Not surveyed	Not surveyed	Not surveyed
99905	Natural	Sand & Mud/Clay	Forest & Shrub

a. Access to Site 99904 was not available when the RUAA surveys were conducted.

Table 4.7 Thalweg depth, stream flow type, and site accessibility during the two surveys of Walnut Creek (1242O).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that much of the surveyed reach was on private property. For Bank Access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, D = Difficult.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
16403	300	10	0	0.58	0.58	Perennial	Public*	E
20021	300	10	0	0.32	0.35	Perennial	Public*	MD
99901	300	10	0	0.42	0.42	Perennial	Private	ME
20565	300	10	0	0.17	0.06	Perennial	Public*	ME
99902	300	10	0	0.30	0.18	Perennial	Public*	ME
99903	300	10	0	0.20	0.13	Perennial	Public*	E
99904 ^a	Not surveyed	Not surveyed	Not surveyed	Not surveyed	Not surveyed	Perennial	Private	Not surveyed
99905	300	10	0	0.07	0.00	Perennial	Public*	MD

a. Access to Site 99904 was not available when the RUAA surveys were conducted.

Table 4.8 Description of surveyed stream sites along Walnut Creek during first survey.

Site	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Flow (cfs)	Observed Flow
16403	11.0	0.8	7.0	5.2	Normal
20021	9.0	6.0	8.0	5.6	Normal
99901	12.0	0.4	3.0	4.6	Normal
20565	4.5	1.5	3.0	0.08	Low
99902	15.0	0.0	4.0	<0.01	Normal
99903	3.0	0.0	2.1	0.0	No Flow
99904 ^a	Not surveyed	Not surveyed	Not surveyed	Not surveyed	Not surveyed
99905	6.0	0.0	0.0	0.0	No Flow

a. Access to Site 99904 was not available when the RUAA survey was conducted.

Table 4.9 Description of surveyed stream sites along Walnut Creek during second survey.

Site	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Flow (cfs)	Observed Flow
16403	11.0	0.8	7.0	5.5	Normal
20021	9.0	5.0	8.0	5.6	Normal
99901	12.0	0.6	3.0	4.9	Normal
20565	3.5	0.3	0.9	<0.05	Low
99902	6.0	0.0	0.0	0.0	No Flow
99903	Not reported	0.0	0.0	0.0	No Flow ^b
99904 ^a	Not surveyed	Not surveyed	Not surveyed	Not surveyed	Not surveyed
99905	0.0	0.0	0.0	0.0	Dry

a. Access to Site 99904 was not available when the RUAA survey was conducted.

b. Stream dry at several locations, although some shallow but nonsignificant pools encountered.

Table 4.10 Stream aesthetics along Walnut Creek during first survey.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NA = not applicable, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
16403	C	R	N	Clear	Fine sediment	Clear	N	N	N	Tracks	N	N	N
20021	A	A	N	Clear	Fine sediment	Clear	N	N	SP	Tracks	N	N	N
99901	R	R	N	Brown	Fine sediment	Clear	SP	N	MP	Tracks	N	N	N
20565	R	A	N	Clear	Fine sediment	Clear	N	N	SP	Tracks	N	N	N
99902	R	R	C	Brown	Fine sediment	Scum/Debris	N	N	MP	Tracks/Fecal	N	N	R
99903	R	R	N	Brown	Fine sediment	Clear	N	N	N	Tracks	N	N	N
99904 ^a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
99905	R	R	N	Brown	Sludge	Clear	N	N	SP	Tracks	C	C	R

a. Access to Site 99904 was not available when the RUAA survey was conducted.

Table 4.11 Stream aesthetics along Walnut Creek during second survey.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NA = not applicable, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
16403	C	R	N	Clear	Sludge	Clear	N	N	N	Tracks	N	N	N
20021	R	A	N	Clear	Fine sediment	Clear	N	N	SP	Tracks	R	R	R
99901	R	C	N	Clear	Fine sediment	Clear	MP	N	LP	Tracks	N	N	N
20565	A	A	N	Clear	Fine sediment	Clear	N	N	SP	Tracks	N	N	N
99902	R	R	C	Brown	Sludge	Scum	N	N	N	Tracks	N	N	N
99903	A	C	N	Brown	Sludge	Scum	N	N	SP	Tracks	N	N	N
99904 ^a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
99905	A	C	N	NA	Fine sediment	NA	N	N	N	Tracks	C	C	C

a. Access to Site 99904 was not available when the RUAA survey was conducted.

Physical Description of 16403

Walnut Creek at Site 16403 was visited on August 10 and 16, 2010. This site, located north of Calvert, Texas in Robertson County, was only accessible to the public in the area of the bridge crossing State Highway 6 for about 50 meters. The remainder of the study reach was located on private lands that were fenced. The site is located in a pasture dominated corridor with a few trees and shrubs spread throughout the reach (Table 4.6). At the site, access to the stream was easy with gentle slopes and the lack of dense vegetation (Table 4.7). Figures 4.2 and 4.3 depict the appearance of the site during each of the surveys.



Figure 4.2 Photograph of Walnut Creek Site 16403 taken on August 10, 2010, the downstream view of the 30-m transect showing the gentle slopes and private property fence.



Figure 4.3 Photograph of Walnut Creek Site 16403 taken on August 16, 2010, the downstream view of the 150-m transect.

Site 16403 was wadeable for the entire 300-m reach length. During both surveys in August, the shallow water, average thalweg of 0.58 meters, and the sandy substrate made for easy wading. Stream widths ranged from 11 m to 0.8 m during both surveys with a normal flow status (Tables 4.8 and 4.9). Four pools were identified during each trip and their dimensions are shown in Tables 4.12 and 4.13. One tree obstruction was observed near the 150-m transect as shown in Figure 4.3.

Table 4.12 Pools encountered at Site 16403 during survey on August 10, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	22	10	1.10
Pool 2	41	4	0.95
Pool 3	73	8	1.15
Pool 4	15	5	1.10

Table 4.13 Pools encountered at Site 16403 during survey on August 16, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	22	10	1.10
Pool 2	41	4	0.95
Pool 3	74	8	1.02
Pool 4	13	5	1.05

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.10 and 4.11, respectively. There were no vertebrates or mammals observed during either survey, although tracks were observed during both trips. Aquatic vegetation was common and algae was rare during both of the surveys. Evidence of human presence was observed in the form of an empty worm box and remains of a fire encountered along the bank during the second survey. There was evidence of fishing present at this site.

Physical Description of 20021

Walnut Creek at site 20021 was visited on June 22 and August 16, 2010. This site, located north of Calvert, Texas in Robertson County, was accessible through private lands that were fenced from County Road 123. Although the site is listed as being publically accessible, access is very limited due to the property fences and dense vegetation at the bridge crossing (Figure 4.4). The corridor along the stream was forest dominated with a natural stream appearance (Table 4.6). Access to the stream was moderately difficult as BRA personnel traversed the property fence and thick vegetation to reach the stream (Table 4.7). Figures 4.4 and 4.5 depict the public accessibility at the road crossing and the appearance of the site during each of the surveys.

Site 20021 was wadeable for the entire 300-m reach length. Average thalweg was from 0.32 m during the first survey to 0.35 m during the second survey (Table 4.7). During both surveys, the shallow water depths and sandy substrate made wading in the stream channel easy. One tree obstruction was encountered during the first survey, which would make boating difficult. Stream widths varied from 9.0 to 6.0 m during the first survey and 9.0 to 5.0 m during the second survey (Tables 4.8 and 4.9).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been provided in Tables 4.10 and 4.11, respectively. There was a slight presence of livestock observed during both surveys and a slight presence of wildlife (i.e., deer) observed during the second survey. No other mammals or vertebrates were observed during either survey. Tracks observed during each trip consisted of cattle, deer, and hog. Aquatic vegetation was absent during the first survey and rare during the second survey. Algae was absent during both surveys. The water color was clear with no surface scum or foam for both surveys. Trash was not observed during the first survey and rarely observed during the second survey and consisted of bottles, cans, and tires. The only sign of recreation found was in the form of a trotline observed during the first survey.



Figure 4.4 Photograph of Walnut Creek Site 20021 taken on August 16, 2010, showing the limited public accessibility at the road crossing.



Figure 4.5 Photograph of Walnut Creek Site 20021 taken on June 22, 2010, the downstream view of the 300-m transect.

Physical Description of 99901

Walnut Creek at Site 99901 was visited on August 10 and 23, 2010. This site, located north of Calvert, Texas in Robertson County, was accessible only through private lands that were gated and fenced with a cattle guard at the property entrance. With landowner permission, BRA personnel entered private property and drove approximately three miles through pasture land to reach the site. The site is located in a pasture dominated corridor (Table 4.6) and is downstream of a mining operation that discharges water into Walnut Creek. At the site of the 0-m transect, access to the stream was easy, although other locations throughout the reach provided more difficult access into the stream due to steep banks. Figures 4.6 and 4.7 depict the appearance of the site during each of the surveys.

Site 99901 was wadeable for the entire 300-m reach length. Average thalweg was 0.42 m during both surveys (Table 4.7). During both surveys, the shallow water depths and sand and mud/clay substrate made wading in the stream channel easy. One round horn culvert was observed near the 30-m transect, which would make tubing or canoeing difficult. Widths of the stream ranged from maximum of 12 m encountered during both surveys to a minimum of 0.4 m encountered during the first survey (Tables 4.8 and 4.9). Two pools were identified during each survey and their dimensions are shown in Tables 4.14 and 4.15.



Figure 4.6 Photograph of Walnut Creek Site 99901 taken on August 10, 2010 showing a large pool and an entry point into the stream.



Figure 4.7 Photograph of Walnut Creek Site 99901 taken on August 23, 2010, the upstream view of the 150-m transect.

Table 4.14 Pools encountered at Sit 99901 during survey on August 10, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	24.0	12.0	>1.2
Pool 2	69.0	6.0	0.59

Table 4.15 Pools encountered at Site 99901 during survey on August 23, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	21.0	10.0	0.95
Pool 2	69.0	6.0	0.59

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.10 and 4.11, respectively. During the first survey, there was a slight presence of feral hogs and wildlife observed with a moderate presence of livestock. There was a large presence of feral hogs and livestock observed during the second survey. Snakes were observed during both trips with a slight to moderate presence from trip one to trip two. No water dependent birds or alligators were observed during either trip. Animal tracks and hog wallows were observed during each trip. Aquatic vegetation was common and algae was rare during both

surveys. The water color was clear with no surface scum or foam. Trash was not observed during either trip.

Physical Description of 20565

Walnut Creek at Site 20565 was visited on June 22 and August 16, 2010. This site, located northeast of Calvert, Texas in Robertson County, was only publically accessible at the bridge crossing Nesbit Road. With landowner permission, BRA personnel traversed over a posted private property fence onto private property to survey the 300-meter reach. The site is located in a pasture and forest dominated corridor (Table 4.6) with moderately easy access to the stream (Table 4.7). Figures 4.8 and 4.9 depict the appearance of the site during each of the surveys.



Figure 4.8 Photograph of Walnut Creek Site 20565 taken on June 22, 2010, the downstream view of the 30-m transect.

Site 20565 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.17 m during the first survey to 0.06 m during the second survey (Table 4.7). During both surveys, the shallow water depths and sandy substrate made wading in the stream channel easy. Widths of the stream ranged from a maximum of 4.5 m during the first survey to a minimum of 0.3 m during the second survey (Tables 4.8 and 4.9). At least two log jam obstructions were encountered during each survey, which would make boating or tubing the stream difficult.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.10 and 4.11, respectively. There was a slight presence of livestock during the both surveys with no other mammals, snakes, or water dependent birds encountered during either survey. Tracks observed during each trip consisted of deer and hogs. Aquatic vegetation ranged from rare to absent between the first and second surveys, respectively.

Algae was absent with no color, odor, surface scum or foam encountered during either survey. One tire was observed in the streambed. No other signs of human presence were observed.



Figure 4.9 Photograph of Walnut Creek Site 20565 taken on August 16, 2010, the downstream view of the 300-m transect.

Physical Description of 99902

Walnut Creek at Site 99902 was visited on June 24 and August 13, 2010. This site, located northeast of Calvert, Texas in Robertson County, was only publicly accessible at the bridge crossing FM 46. Although the site is listed as being publicly accessible, private property fences severely hinder access to the creek as shown in Figure 4.10. The site is located in a pasture and shrub dominated corridor (Table 4.6). At the site, access to the stream was moderately easy due to the thick vegetation, property fence and moderate slopes (Table 4.7). Figures 4.11 and 4.12 depict the appearance of the site during each of the surveys.

Site 99902 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.30 m during the first survey to 0.18 m during the second survey (Table 4.7). During both surveys, the shallow water depths with the sand or mud/clay substrate made wading in the stream channel easy. Widths of the stream ranged from a maximum of 15 m during the first survey to a maximum of 6 m during the second survey when the reach only contained pockets of water (Tables 4.8 and 4.9). There was one fence obstruction with a piece of tin attached near the 0 meter transect. No log obstructions were encountered.



Figure 4.10 Photograph of Walnut Creek Site 99902 taken on August 13, 2010, showing very limited public access at the bridge crossing.



Figure 4.11 Photograph of Walnut Creek Site 99902 taken on June 24, 2010, the upstream view of the 300-m transect.



Figure 4.12 Photograph of Walnut Creek Site 99902 taken on August 13, 2010, the downstream view of the 30-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been provided in Tables 4.10 and 4.11, respectively. During the first survey, there was a slight presence of wildlife, a moderate presence of feral hogs, and a large presence of livestock. No snakes, alligators, or water dependent birds were observed. No animals were encountered during the second survey. Tracks were observed during both surveys and fecal dropping were encountered during the second survey only. Aquatic vegetation and algae were rare during both surveys. The water color was brown during both surveys with surface scum and debris. One oil jug was encountered during the first survey with no other trash encountered during the second survey. No evidence of recreation was observed within the reach.

Physical Description of 99903

Walnut Creek at site 99903 was visited on June 22 and August 13, 2010. This site, located northeast of Calvert, Texas in Robertson County, was publicly accessible only at the bridge crossing FM 2293. Although the site is listed as being publicly accessible, private property fences severely hinder access to the creek. The site is located in a pasture dominated corridor for the entire length of the reach (Table 4.6). At the site, access to the stream was easy (Table 4.7), although other locations within the reach had more challenging entrances due to steep banks, dense vegetation, and trees. Figures 4.13 and 4.14 depict the appearance of the site during each of the surveys.



Figure 4.13 Photograph of Walnut Creek Site 99903 taken on June 22, 2010, the upstream view of the 150-m transect. BRA personnel in photograph.



Figure 4.14 Photograph of Walnut Creek Site 99903 taken on August 13, 2010, the downstream view of the 30-m transect.

Site 99903 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.20 m during the first survey to 0.13 m during the second survey (Table 4.7). During both surveys, the shallow water depths or lack of water with the sandy substrate made wading in the stream channel easy. Widths of the stream ranged from 3.0 m to 0 m during the first survey (Table 4.8). Water widths were not recorded during the second survey as the stream was dry (Table 4.9). One pool was identified during the first survey with a length of 120 meters, width of 2.0 meters and a maximum depth of 0.5 meters. Other than a few overhanging tree branches, there were no obstructions encountered in the stream channel during either survey.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been provided in Tables 4.10 and 4.11, respectively. There was a moderate presence of cattle during the first survey and a slight presence during the second. No other mammals or vertebrates were encountered during either survey. Tracks observed during each trip consisted of cattle and raccoon. Cattle feces were also found throughout the reach during both surveys. Aquatic vegetation and algae were rare during the first survey while aquatic vegetation was absent and algae common during the second survey. The water color was brown during both surveys with surface scum only encountered during the second survey. Trash was not observed during either survey. No evidence of recreational activity was found within the reach.

Physical Description of 99904

Walnut Creek at Site 99904 was located approximately 1.3 miles upstream of Site 99903. Located northeast of Calvert, Texas in Robertson County, was accessible only through private lands that were fenced. On June 22 and August 13, 2010, BRA personnel attempted to contact the landowner to gain access to conduct the survey. Attempts to contact the landowner for access were unsuccessful and as a result the surveys were not completed at this site.

Physical Description of 99905

Walnut Creek at Site 99905 was visited on June 22 and August 13, 2010. This site, located northeast of Calvert, Texas in Robertson County, was publicly accessible only at the bridge crossing Wasik Road. Although the site is listed as being publicly accessible, private property fences overgrown with brush and thick vegetation limit public accessibility as depicted in Figure 4.15. BRA personnel entered private property through the brush and over the fence to reach the site. The site is located in a forest and shrub dominated corridor (Table 4.6). At the site, access to the stream was moderately difficult due to the thick vegetation (Table 4.7). Figures 4.16 and 4.17 depict the appearance of the site during each of the surveys.

Site 99905 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.07 m during the first survey to 0.0 m during the second survey when the stream was dry (Table 4.7). Although the stream channel consisted of sand and mud/clay with shallow to non-existent water depths, traversing the channel was challenging due to vegetation and tree roots covering the bottom of the channel and occasional log obstructions. Widths of the stream ranged from a maximum of 6.0 m at a pool during the first survey to a minimum of 0.0 m encountered during both surveys (Tables 4.8 and 4.9). Two pools were identified during the first survey and their dimensions are shown in Table 4.16.



Figure 4.15 Photograph of Walnut Creek Site 99905 taken on August 13, 2010 showing limited public accessibility.



Figure 4.16 Photograph of Walnut Creek Site 99905 taken on June 22, 2010, the upstream view of the 30-m transect.



Figure 4.17 Photograph of Walnut Creek Site 99905 taken on August 13, 2010, the upstream view of the 300-m transect.

Table 4.16 Pools encountered at Site 99905 during survey on June 22, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	62.0	6.0	0.90
Pool 2	17.0	3.5	0.50

Aesthetic appearance of the water and wildlife observations for the site during each survey have been provided in Tables 4.10 and 4.11, respectively. There was a slight presence of livestock encountered during the first survey with no other vertebrates or mammals observed during either survey. Tracks observed during each trip consisted of cattle and deer. Fecal droppings were not recorded during either survey. Aquatic vegetation and algae was rare during the first survey and limited to the two pools. During the second survey, aquatic vegetation was absent while algae was common. The water color was brown, when present, with no surface scum or foam. Trash was common throughout the reach consisting of bottles, cans, lawn chairs, and appliances. No evidence of human recreational activity was observed within the reach.

Observations and Interviews

Activities Observed

No contact (primary or secondary) or noncontact recreational activities were observed by BRA employees at any of the sites during the field surveys. Evidence of possible recreation was encountered at only two (16403 and 20021) of the eight sites throughout the reach.

Evidence of potential recreation was observed at Site 16403 in the form of an empty worm box and remnants of a campfire. It should also be noted that evidence of fishing has been previously observed at this site by BRA personnel during routine sampling at this location.

At Site 20021, remnants of an old trotline were found during the first survey but not observed during the second survey.

Activities Interviewed

An interview was conducted with one landowner associated with Site 99901 along Walnut Creek, who stated that fishing and children wading were the only identified forms of water recreation occurring on his property along Walnut Creek. The landowner stated that this type of recreation would occur on his property a few times a year. There is a mine located just upstream of the landowner's property that discharges into Walnut Creek. The landowner attributes the constant water flow to the mine discharge, which affords him good fishing holes on his property. As shown in Table 4.17, these were the only instances of recreation noted as occurring along Walnut Creek.

Table 4.17 Summary of recreational activities noted in interviews for Walnut Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location. No recreational activities were observed during field surveys or site visits.

Site	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunting	Fishing	Boating, Canoeing, Kayaking
16403							
20021							
99901	1	0,0,0	0,0,0	1,0,0	0,0,0	1,0,0	0,0,0
20565							
99902							
99903							
99904							
99905							
Totals	1	0,0,0	0,0,0	1,0,0	0,0,0	1,0,0	0,0,0

Summary

RUAA surveys were conducted at eight sites along Walnut Creek during the months of June and August 2010. Six of the eight sites were at road crossings and the other two were on private property. Except for the six road crossings, all access to Walnut Creek is through private property that is fenced, gated, and locked. At the public road crossings, access is typically limited to the area immediately underneath or near the bridge with further access impeded by private fences. The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions during both the June and August 2010 surveys (NCDC, 2014). Water levels were fairly shallow with an overall average thalweg depth of 0.27 m. A few pools were encountered that were greater than 1 m deep. There is a mine located just upstream of Site 99901, which discharges water into Walnut Creek. This typically keeps water in the lower end of the reach where Sites 16403, 20021, and 99901 are located. The remaining sites are above the mine property and generally have insufficient water to promote any form of water recreation.

During the two surveys, there were no contact recreational activities observed by BRA field staff. Additionally, there were no non-contact recreational activities observed during either survey. While conducting the stream surveys, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds, or sports fields, were encountered that would promote recreation. Signs of recreation in the form of a worm box and old trotline were only encountered at Sites 16403 and 20021 indicating that fishing likely had occurred at these locations.

Interviews revealed that children wading and fishing has occurred at Site 99901, but only a few times a year. Recreational activities reported by interviewees are summarized in Figure 4.18. Overall RUAA findings are summarized in the form below.

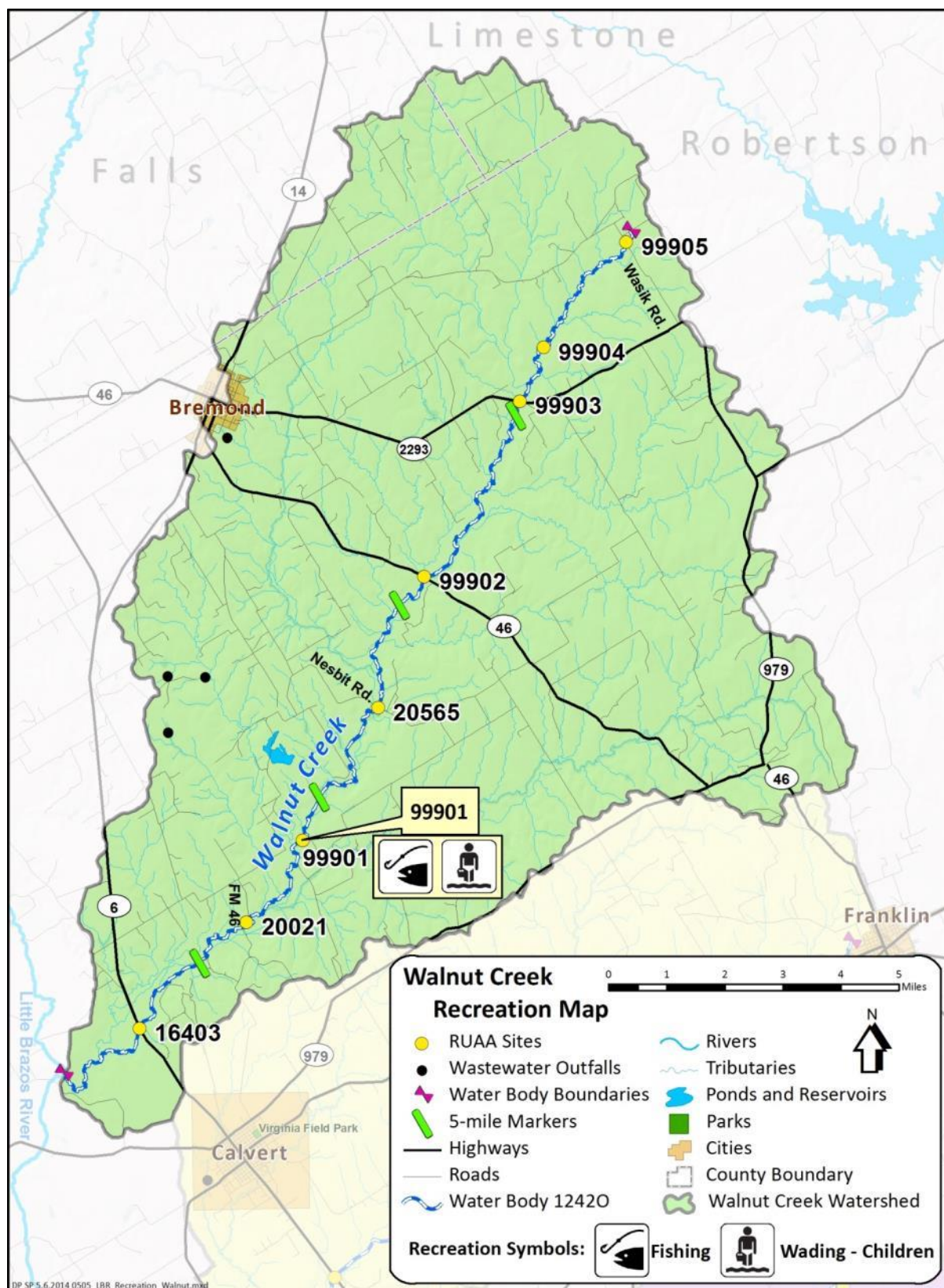


Figure 4.18 Summary of observed and interviewed recreational activities on Walnut Creek.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Walnut Creek

Segment No. of Nearest Downstream Segment No.: Segment 12420

Classified: Perennial (unclassified water body)

County: Robertson

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

b. Do secondary contact recreation 1 activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

c. Do secondary contact recreation 2 activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

d. Do noncontact recreation activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

2. Physical Characteristics of Water Body

a. What is the average thalweg depth? 0.27 meters

b. Are there substantial pools deeper than 1 meter? ☒ Yes ☐ No

c. What is the general level of public access?

☐ easy ☐ moderate ☒ very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

☐ Mild-Extreme Drought

☐ Incipient dry spell

☐ Near Normal

☐ Incipient wet spell

☒ Mild-Extreme Wet

Chapter 5

Mud Creek (1242K)

Survey Site Descriptions

Five sampling sites were located along Mud Creek, 1242K (Figure 5.1 and Table 5.1). All five sites were located at public road crossings. It should be noted that at these five publically accessible locations, there was actually very limited public access at three of the five sites due to property fences. RUAA surveys were performed in June and August of 2010 at these locations. A brief description of each site follows.

Site 16402 is located on Mud Creek at State Highway 6 approximately 4.5 miles northwest of Hearne, Texas and 1.97 miles from the confluence with the Little Brazos River. Site 16402 was accessible at the area immediately underneath the bridge crossing. Downstream access is impeded by a fence that completely crosses the stream channel located immediately on the downstream side of the highway crossing. A railroad trestle is located approximately 120 meters upstream of the State Highway 6 bridge. Construction of a new highway bridge was occurring during the August survey. Site 16402 was selected because it is an established TCEQ sampling location that is publicly accessible and provides characterization of the lower portion of water body 1242K.

Site 99906 is located on Mud Creek on Mud Creek Road approximately 3.3 miles east of Calvert, Texas and 2.6 miles upstream of Site 16402. Site 99906 was accessible at the area immediately underneath the bridge crossing. The site was selected because of public accessibility and the opportunity for characterization of water body 1242K.

Site 20562 is located on Mud Creek on Robertson County Road 160 (also known as Jack Brewer Road) approximately 6.3 miles east of Calvert, Texas and 4.4 miles upstream of site 99906. Site 20562 was accessible at the area immediately underneath the bridge crossing however the stream is fenced on the downstream side of the bridge. The site was selected because it is an established TCEQ sampling location and the site provided opportunity for characterization of water body 1242K.

Site 99907 is located on Mud Creek on State Highway 79 approximately 1 mile west of Franklin, Texas and 5.9 miles upstream of Site 20562. The site is located downstream of the City of Franklin WWTP discharge. Site 99907 was accessible at the area immediately underneath the bridge crossing however the stream was fenced off immediately downstream of the bridge crossing. The site was selected because of the potential for public access and the site provided opportunity for characterization of water body 1242K.

Site 99908 is located on Mud Creek at FM 1644 (also known as Dechard Street) approximately 0.7 miles west of Franklin, Texas. The site is located just upstream of the City of Franklin WWTP discharge. Site 99908 provided access to the area immediately at the road crossing however Mud Creek was fenced off directly upstream and downstream of the crossing. The site was selected to characterize the uppermost portion of water body 1242K.

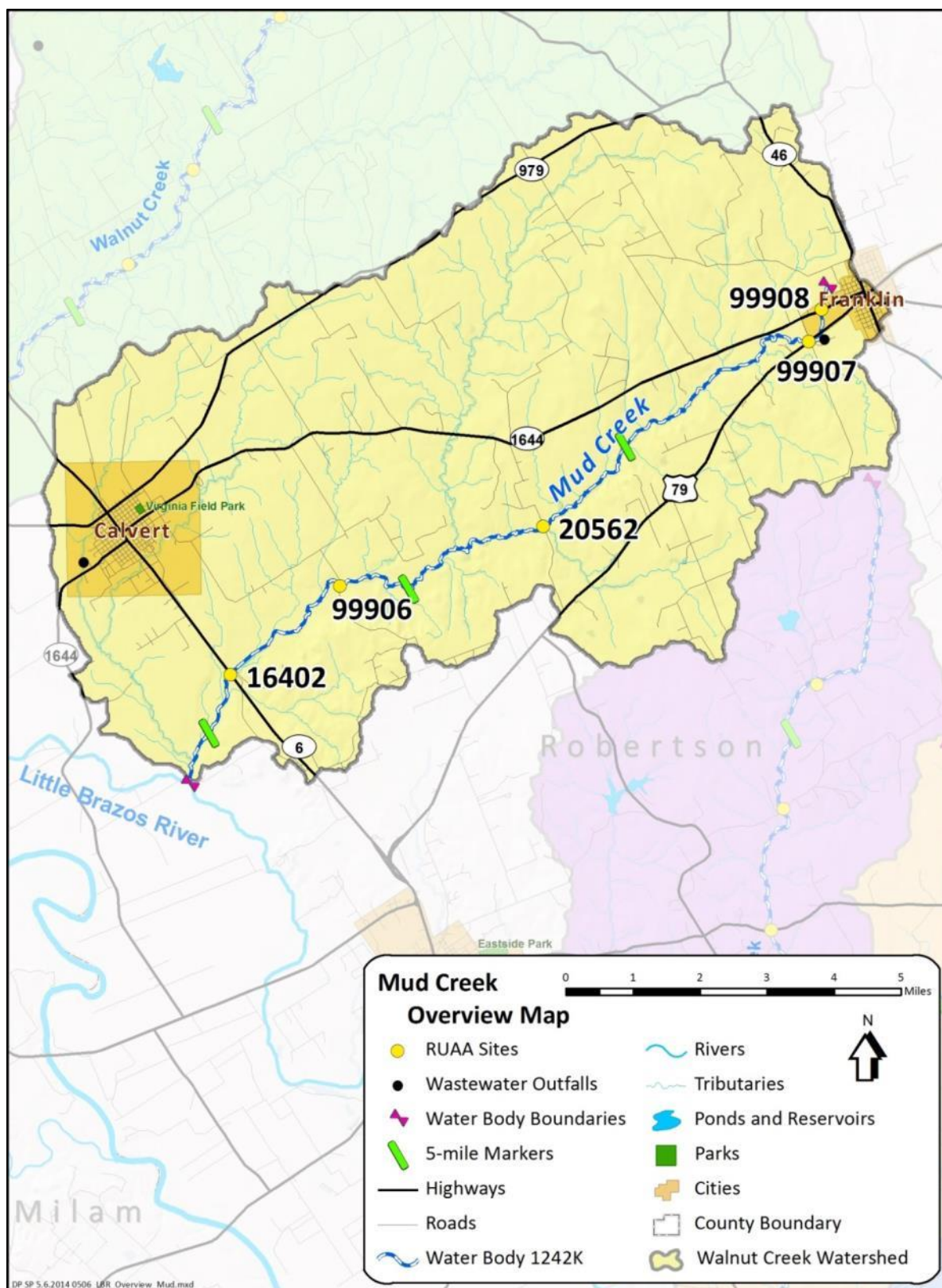


Figure 5.1 Overview of Mud Creek watershed and RUAA sites for water body 1242K.

Table 5.1 Description and location of RUAA field survey sites for Mud Creek (1242K).

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

Site ID^a	Site Description	Latitude	Longitude	Distance from Previous Site (miles)^b	Access
16402	Mud Creek at State Highway 6	30.9468	-96.6473	1.97 (distance to outlet)	Public*
99906	Mud Creek at Mud Creek Road	30.9656	-96.6194	2.57	Public*
20562	Mud Creek at Jack Brewer Road/Robertson CR 160	30.9775	-96.5680	4.39	Public*
99907	Mud Creek at HWY 79	31.0163	-96.5002	5.92	Public*
99908	Mud Creek at FM 1644/Dechard St.	31.0231	-96.4968	0.68	Public*

- When applicable, TCEQ station identification numbers were used for RUAA site IDs. Sites with identification numbers starting with 999 were sites without recognized TCEQ station identification numbers and are specific to this project.
- Distances were calculated using the snap (editing) tool, followed by the split line at point (data management) tool in ArcInfo 10.0.
- Distance from most upstream site to beginning of assessment unit is 0.4 miles.

Field Survey Results

General Description of RUAA Survey Sites and Conditions

The Mud Creek RUAA surveys were conducted in June and August 2010 at all five sites. Air temperatures prior and during both the first and second surveys were above 21°C (70°F), which as indicated by the RUAA guidelines is warm enough to promote recreational activities (Tables 5.2 and 5.3).

Based on precipitation records for Franklin, Texas; in the 30 days prior to the first survey, 4.6 inches of precipitation fell, while 3.04 inches fell 30 days prior to the second survey. Temperatures on the survey dates were typically warmer in August than in June (Tables 5.2 and 5.3). The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions during both the June and August 2010 surveys (NCDC, 2014).

A summary of the RUAA field survey results is presented in the following tables:

- Table 5.6 describes the stream channel and corridor characteristics at each site.
- Table 5.7 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 5.8 and 5.9 document the maximum, minimum, and average stream widths at each site for each survey as well as the flow and observed flow conditions.
- Tables 5.10 and 5.11 note stream aesthetics, wildlife observations, and tracks, and the presence of garbage by site observed during each site and survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall thalweg depth ranged from 0 m to 0.64 m during the first survey and 0 m to 0.54 m during the second survey. Access to the stream down the bank was moderately difficult in most locations due to steep banks and dense vegetation. The dominant substrate was sand and the stream corridor was largely lined with trees and shrubs. The maximum stream width encountered was 9 m during the first survey in June 2010 and 7 m during the second survey in August. Flow conditions were largely normal during both surveys with dry conditions encountered only at the most upstream survey site. Trash was rarely to commonly observed at the three most downstream survey sites and only rarely observed at the two most upstream sites. No recreation was directly observed and no signs of potential recreation were observed during either of the field surveys.

Table 5.2 Air and water temperatures for each site during the first RUAA survey on Mud Creek.

Site	Date	Air Temp (C°)	Water Temp (C°)
16402	25Jun10	32.3	25.6
99906	23Jun10	29.0	27.0
20562	23Jun10	28.9	26.0
99907	23Jun10	27.3	27.0
99908	23Jun10	26.7	NA

Table 5.3 Air and water temperatures for each site during the second RUAA survey on Mud Creek.

Site	Date	Air Temp (C°)	Water Temp (C°)
16402	27Aug10	33.3	24.8
99906	27Aug10	29.4	24.8
20562	24Aug10	37.2	26.8
99907	27Aug10	27.2	23.7
99908	24Aug10	36.1	NA

Table 5.4 Rainfall records 30 days prior to the first RUAA survey on Mud Creek.

Survey dates vary by site with the earliest initiated on June 23, 2010. Days of surveys are highlighted in gray.

Date	Franklin TX US GHCND:USC00413321 (in.)
24-May-2010	0.00
25-May-2010	0.00
26-May-2010	0.00
27-May-2010	0.00
28-May-2010	0.00
29-May-2010	0.00
30-May-2010	0.00
31-May-2010	0.00
1-Jun-2010	0.00
2-Jun-2010	1.25
3-Jun-2010	1.30
4-Jun-2010	0.00
5-Jun-2010	0.00
6-Jun-2010	0.00
7-Jun-2010	0.00
8-Jun-2010	1.16
9-Jun-2010	0.84
10-Jun-2010	0.00
11-Jun-2010	0.00
12-Jun-2010	0.00
13-Jun-2010	0.00
14-Jun-2010	0.00
15-Jun-2010	0.00
16-Jun-2010	0.00
17-Jun-2010	0.00
18-Jun-2010	0.00
19-Jun-2010	0.00
20-Jun-2010	0.00
21-Jun-2010	0.00
22-Jun-2010	0.01
23-Jun-2010	0.00
24-Jun-2010	0.00
25-Jun-2010	0.00

Table 5.5 Rainfall records 30 days prior to the second RUAA on Mud Creek.

Survey dates vary by site with the earliest initiated on August 24, 2010. Days of surveys are highlighted in gray.

Date	Franklin TX US GHCND:USC00413321 (in.)
25-Jul-2010	0.00
26-Jul-2010	0.03
27-Jul-2010	0.00
28-Jul-2010	1.86
29-Jul-2010	0.81
30-Jul-2010	0.00
31-Jul-2010	0.00
1-Aug-2010	0.00
2-Aug-2010	0.00
3-Aug-2010	0.00
4-Aug-2010	0.00
5-Aug-2010	0.00
6-Aug-2010	0.00
7-Aug-2010	0.00
8-Aug-2010	0.00
9-Aug-2010	0.00
10-Aug-2010	0.00
11-Aug-2010	0.00
12-Aug-2010	0.00
13-Aug-2010	0.00
14-Aug-2010	0.00
15-Aug-2010	0.00
16-Aug-2010	0.00
17-Aug-2010	0.31
18-Aug-2010	0.00
19-Aug-2010	0.03
20-Aug-2010	0.00
21-Aug-2010	0.00
22-Aug-2010	0.00
23-Aug-2010	0.00
24-Aug-2010	0.00
25-Aug-2010	0.00
26-Aug-2010	0.00
27-Aug-2010	0.00

Table 5.6 Stream Channel and corridor appearance for each site sampled along Mud Creek (1242K).

Site	Stream Channel Appearance	Dominant Substrate	Corridor Appearance
16402	Natural	Sand with mud/clay	Pasture
99906	Natural	Cobble with Gravel	Forest/Shrub & Pasture
20562	Natural	Gravel with Sand	Forest & Shrub
99907	Natural	Sand	Forest & Shrub
99908	Natural	Sand with mud/clay	Pasture

Table 5.7 Thalweg depth, stream flow type, and site accessibility during the two surveys of Mud Creek (1242K).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access,* indicates that the site was publically accessible at a road crossing but that much of the surveyed reach was located on private property For Bank Access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, D = Difficult.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
16402	300	10	0	0.64	0.54	Intermittent with Pools	Public*	MD
99906	300	11	0	0.46	0.32	Intermittent with Pools	Public*	MD
20562	300	11	0	0.30	0.22	Intermittent with Pools	Public*	MD
99907	300	11	0	0.31	0.27	Intermittent with Pools	Public*	ME
99908	0	1	0	0	0	Intermittent with Pools	Public*	ME

Table 5.8 Description of surveyed stream sites along Mud Creek during first survey.

Site	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Flow (cfs)	Observed Flow
16402	9.0	4.0	5.0	2.3	Normal
99906	8.5	1.0	2.0	2.0	Normal
20562	7.0	1.0	5.0	1.9	Normal
99907	5.0	0.5	3.0	0.06	Low
99908	0.0	0.0	0.0	0.0	Dry

Table 5.9 Description of surveyed stream sites along Mud Creek during second survey.

Site	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Flow (cfs)	Observed Flow
16402	6.0	4.0	5.0	0.13	Low
99906	3.0	1.2	1.8	0.34	Normal
20562	7.0	0.5	3.5	0.70	Normal
99907	3.5	0.5	3.0	<0.05	Normal
99908	0.0	0.0	0.0	0.0	Dry

Table 5.10 Stream aesthetics along Mud Creek during first survey.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
16402	C	R	R	Clear	Fine sediment	Clear	SP	N	MP	Tracks/Fecal/ Nest	R	R	C
99906	R	C	N	Clear	N	Clear	N	N	LP	Tracks	R	C	R
20562	R	R	R	Clear	N	Clear	N	N	LP	Tracks/Fecal	C	R	R
99907	R	C	R	Green	Fine sediment	Clear/Scum	SP	N	N	Nest	N	R	R
99908	A	A	N	NA	N	NA	N	N	MP	Tracks/Fecal	N	N	N

Table 5.11 Stream aesthetics along Mud Creek during second survey.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
16402	C	C	C	Green	Other	Clear	N	N	N	N	N	N	C
99906	R	C	C	Clear	Sludge	Clear	N	N	N	Tracks	C	Ab	R
20562	A	R	R	Clear/Green	Fine sediment	Clear	N	N	SP	Tracks	C	R	C
99907	Ab	Ab	Ab	Green	Fine sediment	Clear/Scum	N	N	SP	N	N	N	N
99908	A	A	A	Not applicable	Fine sediment	Not applicable	N	N	SP	N	N	N	N

Physical Description of 16402

Mud Creek at Site 16402 was visited on June 25 and August 27, 2010. This site, located on State Highway 6 approximately 4.5 miles northwest of Hearne, Texas, was accessible at the area immediately underneath the bridge crossing via a concrete curtain. Accessibility to the stream was moderately difficult due to tall, dense vegetation along the steep stream banks (Figure 5.2). Downstream access was blocked due to a fence that crossed the stream immediately downstream of the State Highway 6 crossing. Deep deposits of sludge were encountered on the streambed that began at the State Highway 6 crossing and ended at the 120-meter transect. Log jams were also encountered along the survey reach (Figure 5.3). Figures 5.2 and 5.3 depict the appearance of the site during each of the surveys. Average thalweg depth was 0.64 meters during the June event and 0.54 meters during the August event. Five pools were identified during the June survey and two were identified during the August survey, most of which were over a meter deep (Tables 5.12 and 5.13).



Figure 5.2 Photograph of Mud Creek Site 16402 taken on June 25, 2010, the downstream view of the 30-m transect.



Figure 5.3 Photograph of Mud Creek Site 16402 taken on August 27, 2010, the downstream view of the 300-m transect.

Table 5.12 Pools encountered during survey of Site 16402 on June 25, 2010

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	15	9.0	1.01
Pool 2	30	9.0	1.50
Pool 3	20	9.0	> 1.80
Pool 4	52	6.0	0.75
Pool 5	72	6.0	0.90

Table 5.13 Pools encountered during survey of Site 16402 on August 27, 2010

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	32	6.0	> 1.20
Pool 2	60	6.0	> 1.02

Aesthetic appearance of the water and wildlife observations for the site during each survey have been provided in Tables 5.10 and 5.11, respectively. A slight presence of snakes was observed during the June survey and no vertebrates were observed during the August survey. A moderate presence of livestock and feral hogs was noted based on tracks and fecal droppings. Bird nests were observed during the June survey but not during the August survey. During the June survey, trash within the channel was rare and trash along the stream bank was common and consisted of household garbage. During the August survey, trash was non-existent within the channel and common along the bank. No human presence or signs of recreation were observed within the reach.

Physical Description of 99906

Mud Creek at Site 99906 was visited on June 23 and August 27, 2010. This site is located at Mud Creek Road approximately 3.3 miles east of Calvert, Texas and 2.5 miles upstream of Site 16402. Site 99906 was accessible at the area immediately underneath the bridge crossing. Accessibility to the stream was moderately difficult due to steep, overgrown stream banks. During the August survey large debris piles composed of logs and other woody debris within the stream channel were observed throughout the reach. Figures 5.4 and 5.5 depict the appearance of the site during each of the surveys. Average thalweg depth was 0.46 meters during the June event and 0.32 meters during the August event. Five pools were identified during the June survey (Table 5.14); however, all five were less than 1 m deep. No pools were identified in the August survey.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.10 and 5.11, respectively. No vertebrates were observed during either survey. A large number of feral hog tracks were observed during both surveys as well as some cattle and a few wild animal tracks. During the June survey, small sized garbage within the channel was common and consisted of bottles, cans, and tires. During the August survey trash within the channel was common for large sized garbage and small sized garbage was abundant while garbage on the stream bank was rare. No human presence or signs of recreation were observed within the reach.

Table 5.14 Pools encountered during survey of Site 99906 on June 23, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	15	5.0	0.90
Pool 2	20	4.0	0.85
Pool 3	10	7.0	0.81
Pool 4	16	5.0	0.90
Pool 5	10	8.0	0.65



Figure 5.4 Photograph of Mud Creek Site 99906 taken on June 23, 2010, the upstream view of the 30-m transect.



Figure 5.5 Photograph of Mud Creek Site 99906 taken on August 27, 2010, the upstream view of the 300-m transect.

Physical Description of 20562

Mud Creek at Site 20562 was visited on June 23 and August 24, 2010. This site is located on Robertson County Road 160 (also known as Jack Brewer Road) approximately 6.3 miles east of Calvert, Texas and 4.4 miles upstream of Site 99906. Site 20562 was accessible at the area immediately underneath the bridge crossing; however, the stream is fenced on the downstream side of the bridge. Accessibility to the stream was moderately difficult due to steep overgrown banks. During the two surveys, rip rap composed mostly of woody debris was encountered within the stream channel at the 30 meter transect. Figures 5.6 and 5.7 depict the appearance of the site during each of the surveys.

Average thalweg depth was 0.30 meters during the June survey and 0.22 meters during the August survey. Four pools were identified during the June survey but only two during the August survey (Tables 5.15 and 5.16). Of these pools, only Pool 4 encountered in June was deeper than 1 meter.



Figure 5.7 Photograph of Mud Creek Site 20562 taken on August 24, 2010, the upstream view of the 30-m transect.



Figure 5.8 Photograph of Mud Creek Site 20562 taken on August 24, 2010, the upstream view of the 30-m transect.

Table 5.15 Pools encountered during survey of Site 20562 on June 23, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	25	5.0	0.45
Pool 2	25	7.0	0.90
Pool 3	10	5.0	0.85
Pool 4	26	6.0	1.10

Table 5.16 Pools encountered during survey of Site 20562 on August 24, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	11	7.0	0.90
Pool 2	16	5.0	0.85

Aesthetic appearance of the water and wildlife observations for Mud Creek have been provided in Tables 5.10 and 5.11, respectively. During the June survey a slight presence of wild animals, a moderate presence of feral hogs, and a large presence of livestock was noted. During the August survey a slight presence of livestock and feral hogs were observed. Evidence of wild animals, livestock, and hogs included tracks, hog wallows, and fecal droppings. Cattle were also observed within the stream channel during the August survey. During the June survey, large sized garbage within the channel was common and included tires and furniture while small garbage and bank garbage was rarely observed. During the August survey large sized garbage and garbage along the banks was common and consisted of tires and furniture while small garbage within the stream channel was rare. No evidence of human presence or recreation was observed within the reach.

Physical Description of 99907

Mud Creek at Site 99907 was visited on June 23 and August 27, 2010. This site is located on State Highway 79 approximately 1 mile west of Franklin, Texas, and 5.9 miles upstream of Site 20562. The site is located downstream of the City of Franklin WWTP discharge. Site 99907 was accessible at the area immediately underneath the bridge crossing; however, the stream was fenced off immediately downstream of the bridge crossing. Accessibility to the stream was moderately easy due to the mowed State Highway 79 right-of-way. Log jams within the stream channel and thick vegetation along the banks were encountered during both surveys. Figures 5.9 and 5.10 depict the appearance of the site during each of the surveys. Average thalweg depth was 0.31 meters during the June event and 0.27 meters during the August event. Five pools were identified during the June survey and one was identified during the August survey, all with depths less than 1 meter (Tables 5.17 and 5.18).



Figure 5.9 Photograph of Mud Creek Site 99907 taken on June 23, 2010, the upstream view of the 300-m transect. BRA personnel in photograph.

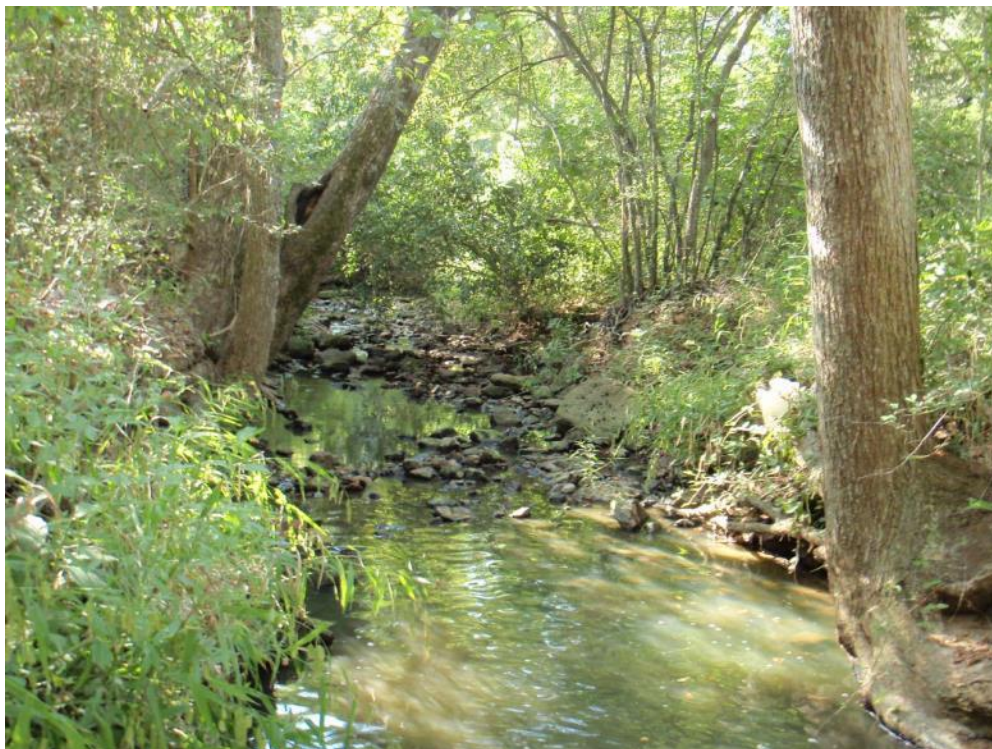


Figure 5.10 Photograph of Mud Creek Site 99907 taken on August 27, 2010, the upstream view of the 300-m transect.

Table 5.17 Pools encountered during survey of Site 99907 on June 23, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	11	3.5	0.32
Pool 2	11	3.0	0.28
Pool 3	23	3.0	0.28
Pool 4	12	4.0	0.46
Pool 5	12	4.0	0.85

Table 5.18 Pools encountered during survey of Site 99907 on August 27, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	23	2.5	0.70

Aesthetic appearance of the water and wildlife observations for the site during each survey have been provided in Tables 5.10 and 5.11, respectively. During the June survey a slight presence of snakes were observed. Bird nests were the only other evidence of wild animals at the site during the June survey. During the August survey, deer were observed near the stream; however, no other evidence of vertebrates or mammals was observed. During the June survey, small sized garbage within the channel and garbage along the banks was rare. During the August survey no garbage was observed in or near the stream. No human presence or signs of recreation were observed within the reach.

Physical Description of 99908

Mud Creek at Site 99908 was visited on June 23 and August 24, 2010. This site is located on Mud Creek at RM 1644 (also known as Dechard Street) approximately 0.70 miles west of Franklin, Texas and just upstream of the City of Franklin WWTF discharge. Franklin High School and athletic complex are located approximately 350 m west of this site. Accessibility to the stream was moderately easy at the area immediately adjacent to the road crossing; however, fences on the upstream and downstream side of the bridge crossing prohibited access past the boundaries of the FM 1644 right-of-way, so observations were made only from the FM 1644 crossing. This headwaters portion of Mud Creek may be characterized as a slight depression with no distinguishable channel in a cattle pasture. This portion of Mud Creek was completely dry at the time of the surveys. Figures 5.11 and 5.12 depict the appearance of the site during each of the surveys.

Aesthetic appearance of the water and wildlife observations for the site have been provided in Tables 5.10 and 5.11, respectively. During the June survey a moderate presence of cattle in the pasture surrounding the site. During the August survey a slight presence of cattle and horses were observed in the same pasture area. Tracks and fecal droppings were observed during the June event and serve as evidence of wildlife in the vicinity of this site. No garbage was observed at this site and no evidence of human presence or recreation was observed within the reach.



Figure 5.11 Photograph of Mud Creek Site 99908 taken on June 23, 2010, the upstream view from FM 1644.



Figure 5.12 Photograph of Mud Creek Site 99908 taken on August 24, 2010, the upstream view from FM 1644.

Observations and Interviews

Activities Observed

No contact (primary or secondary) or noncontact recreational activities were at any of the sites during the field surveys. No evidence of possible recreation was encountered at any site.

Activities Interviewed

Two individuals that were familiar with the Mud Creek watershed were interviewed (Table 5.19). Both individuals claimed to have not personally used, seen others use, or heard of others using the stream for any form of recreation. One of the interviews noted that the reason the creek is not used for recreation is because creek is usually dry or has shallow pools.

Table 5.19 Summary of recreational activities noted in interviews for Mud Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location. No recreational activities were observed during field surveys or site visits.

Site or Location	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunting	Fishing	Boating, Canoeing, Kayaking
16402							
99906							
20562							
99907	1	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
99908							
General to Mud Creek	1	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
Totals	2	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0

Summary

Two RUAA surveys were conducted at five sites along Mud Creek (1242K) during June and August 2010. During the two surveys, there were no contact recreational activities observed by BRA field staff. Additionally, there were no non-contact recreational activities observed during either survey. The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions during both the June and August 2010 surveys (NCDC, 2014). Water depths encountered were fairly low with an overall average thalweg of 0.3 meters. Only a few pools encountered were deeper than 1 meter.

While conducting the stream surveys, no characteristics were encountered that would promote recreation on Mud Creek, such as parks or boat ramps. Franklin High School and associated sports fields are located within 350 m of Site 99908; however, fences prohibit access upstream and downstream of this location.

Most of the access to Mud Creek is via private property, which would also likely deter recreational activities. Areas of the stream open to the public are limited to the right-of-way areas immediately underneath the bridge crossings as shown in Figure 5.1. At the five sites surveys, which were at road crossings, access was limited to the area immediately underneath the bridge. On the downstream side of sites 16402, 99906, and 9907, access beyond the area near each bridge was impeded due to fences located immediately downstream of the highway right of way. At Site 99908 both the upstream and downstream access is blocked by fences located immediately outside of the FM 1644 right of way.

Interviews from two individuals that were familiar with Mud Creek revealed that they have not personally used, seen others use or heard of others using Mud Creek for any form of recreation.

A recreational activity map is not provided for Mud Creek as no forms of recreation were observed or noted in interview for this water body.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Mud Creek

Segment No. of Nearest Downstream Segment No.: Segment 1242

Classified: Intermittent with Pools (unclassified water body)

County: Robertson

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

b. Do secondary contact recreation 1 activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

c. Do secondary contact recreation 2 activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

d. Do noncontact recreation activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

2. Physical Characteristics of Water Body

a. What is the average thalweg depth? 0.30 meters

b. Are there substantial pools deeper than 1 meter? ☒ Yes ☐ No

c. What is the general level of public access?

☐ easy ☐ moderate ☒ very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

☐ Mild-Extreme Drought

☐ Incipient dry spell

☐ Near Normal

☐ Incipient wet spell

☒ Mild-Extreme Wet

Chapter 6

Pin Oak Creek (1242L)

Survey Site Descriptions

Five sampling sites were established along water body 1242L (Figure 6.1 and Table 6.1). All five sites were located at public road crossings that did not require permission for access to the creek, but did require landowner cooperation to conduct the full 300-m assessment. At only one site (16401) was public access limited by property fences near the road crossing. RUAA surveys were performed in June and August of 2010. A brief description of each site follows.

Site 16401 is located on Pin Oak Creek at SH 6 / US 190, approximately 2 miles southeast of Hearne, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242L.

Site 20385 is located on Pin Oak Creek 75 m upstream of the FM 2549 east of Hearne, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242L.

Site 20563 is located on Pin Oak Creek at FM 391, 103 m north and 1.61 km east from the intersection of FM 391 and FM 2549 in Robertson County. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242L.

Site 99910 is located on Pin Oak Creek at Pin Oak Road, approximately 0.8 miles southwest of the intersection of Pin Oak Road and CR 228 in Robertson County. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242L.

Site 99911 is located on Pin Oak Creek at Pin Oak Road, approximately 1.4 miles north of the intersection of Pin Oak Road and CR 228 in Robertson County. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242L.

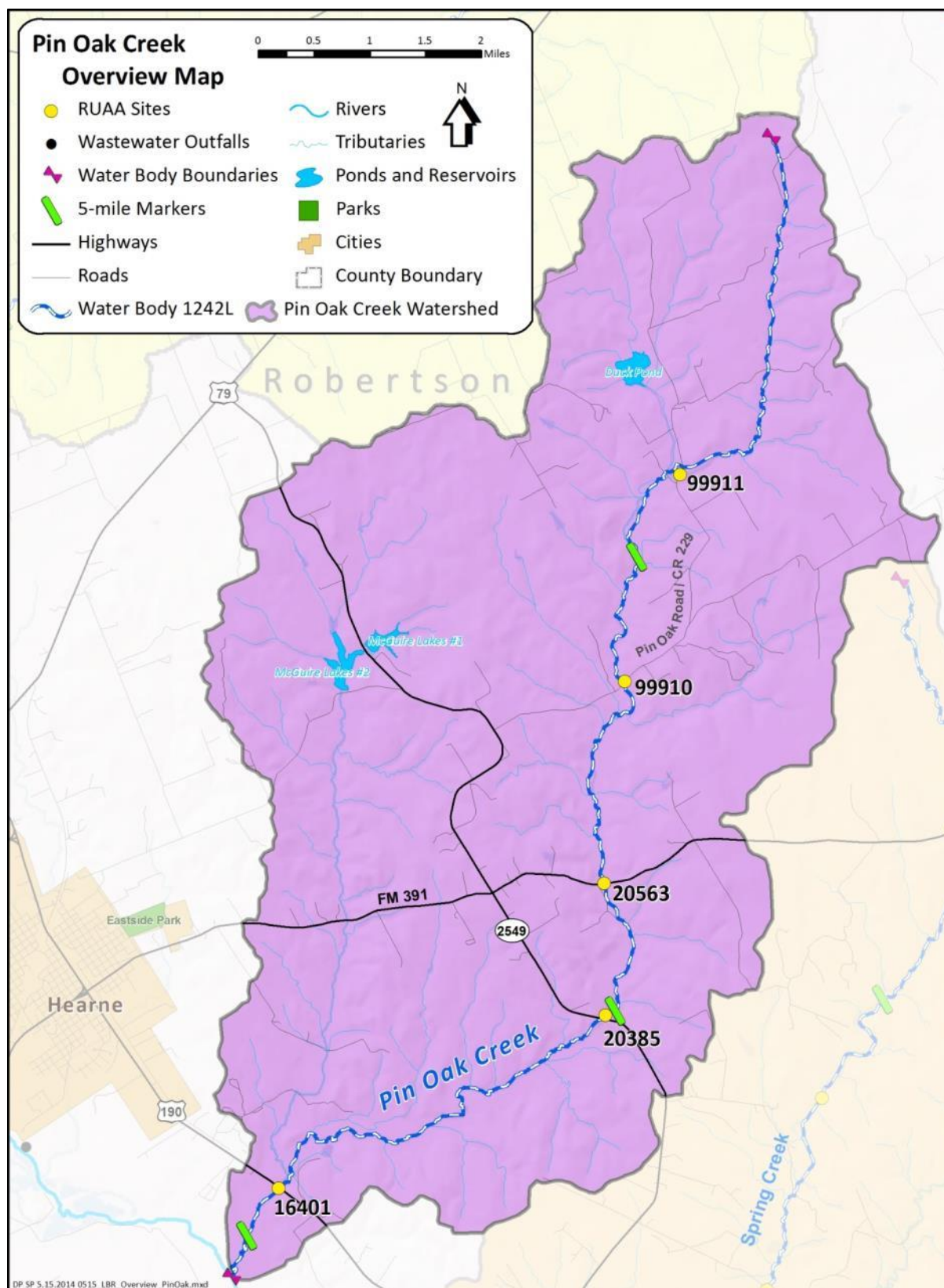


Figure 6.1 Overview of Pin Oak Creek watershed and RUAA sites for water body 1242L.

Table 6.1 Description and location of RUAA field survey sites for Pin Oak Creek (1242L).

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

Site ID^a	Site Description	Latitude	Longitude	Distance from Previous Site (miles)^b	Access
16401	Pin Oak Creek at SH 6 / US 190	30.8502	-96.5631	1.09 (distance to outlet)	Public*
20385	Pin Oak Creek 75 m upstream of FM 2549	30.8718	-96.5132	4.37	Public
20563	Pin Oak Creek at FM 391	30.8890	-96.5130	1.44	Public
99910	Pin Oak Creek at Pin Oak Road / CR 229 south of intersection with CR 228	30.9152	-96.5091	2.23	Public
99911	Pin Oak Creek at Pin Oak Road / CR 229 north of intersection with CR 228	30.9420	-96.5001	2.46 ^c	Public

a. When applicable, TCEQ station identification numbers were used for RUAA site IDs. Sites with identification numbers starting with 999 were sites without recognized TCEQ station identification numbers and are specific to this project.

b. Distances were calculated using the snap (editing) tool, followed by the split line at point (data management) tool in ArcInfo 10.0.

c. Distance from most upstream site to beginning of assessment unit is 3.96 miles.

Field Survey Results

General Description of RUAA Survey Sites and Conditions

The Pin Oak Creek RUAA surveys were conducted on weekdays in the months of June and August, 2010. Air and water temperatures during both the first and second surveys were above 21°C (70°F), indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 6.2 and 6.3). Precipitation records for the 30 days prior to each survey are shown in Tables 6.4 and 6.5. The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions during both the June and August 2010 surveys (NCDC, 2014).

A summary of the RUAA field survey results is presented in the following tables:

- Table 6.6 describes the stream channel and corridor characteristics at each site.
- Table 6.7 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 6.8 and 6.9 document the maximum, minimum, and average stream widths at each site for each survey as well as the flow and observed flow conditions.
- Tables 6.10 and 6.11 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each site and survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall thalweg depth averaged 0.30 m during the first survey and 0.25 m during the second survey. Depth readings at dry transects were recorded as zero. Access to the stream down the bank was easy to moderately easy in most locations due to low banks and the absence of impeding fences. Fine-textured substrates dominated (e.g., mud, clay, and silt), and the stream corridor was largely lined with shrubs and grasses though the immediate riparian zone (within 10 m of the stream channel) was generally forest with thick underbrush. The maximum stream width encountered was 14 m during the first survey and 18 m during the second survey. During the June survey, flow was negligible to non-existent at three of the five sites (Table 6.8). The other two sites, 20385 and 20563, located in the middle-lower portion of water body 1242L, had flows of 0.54 and 0.30 cfs, respectively, which was deemed normal for that reach. Dry to low flow conditions were recorded at the survey sites in August. The water surface varied from clear to brown and scum was occasionally noted on stagnant pools. Cattle and hog tracks were observed most often. Trash was rarely observed at most survey sites and when observed was predominantly typical plastics and aluminum cans. No recreation was directly observed during either of the field surveys nor were there signs of potential recreation.

Table 6.2 Air and water temperatures for each site during the first RUAA on Pin Oak Creek.

Site	Date	Air Temp (°C)	Water Temp (°C)
16401	09Aug10	33.3	30.1
20385	29Jun10	27.8	25.9
20563	28Jun10	35.0	26.7
99910	28Jun10	33.9	NA
99911	28Jun10	29.4	29.4

Table 6.3 Air and water temperatures for each site during the second RUAA on Pin Oak Creek.

Site	Date	Air Temp (°C)	Water Temp (°C)
16401	23Aug10	31.7	27.2
20385	23Aug10	35.0	28.4
20563	20Aug10	34.4	26.5
99910	20Aug10	33.9	NA
99911	20Aug10	31.1	NA

Table 6.4 Rainfall records 30 days prior to the first RUAA survey on Pin Oak Creek for all sites except Site 16401.

Survey dates vary by site with the earliest initiated on June 28, 2010. Days of surveys are highlighted in gray.

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
29May10	0.00	0.00
30May10	0.00	0.00
31May10	0.00	0.00
01Jun10	0.00	0.00
02Jun10	0.56	0.00
03Jun10	0.82	1.25
04Jun10	0.00	1.30
05Jun10	0.00	0.00
06Jun10	0.00	0.00
07Jun10	0.00	0.00
08Jun10	0.24	0.00
09Jun10	4.27	1.16
10Jun10	0.00	0.84
11Jun10	0.00	0.00
12Jun10	0.00	0.00
13Jun10	0.00	0.00
14Jun10	0.00	0.00
15Jun10	0.00	0.00
16Jun10	0.00	0.00
17Jun10	0.00	0.00
18Jun10	0.00	0.00
19Jun10	0.00	0.00
20Jun10	0.00	0.00
21Jun10	0.00	0.00
22Jun10	0.00	0.00
23Jun10	0.00	0.01
24Jun10	1.39	0.00
25Jun10	0.00	0.00
26Jun10	0.00	0.00
27Jun10	0.00	0.00
28Jun10	0.01	0.00
29Jun10	0.00	0.00

Table 6.5 Rainfall records 30 days prior to the first survey for Site 16401 and the second RUAA survey for all sites on Pin Oak Creek.

Survey dates vary by site with the earliest initiated on August 9, 2010 as the first survey of Site 16401. Days of surveys are highlighted in gray.

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
10Jul10	0.00	0.00
11Jul10	0.00	0.00
12Jul10	0.00	0.00
13Jul10	0.00	0.00
14Jul10	0.00	0.00
15Jul10	0.00	0.00
16Jul10	0.00	0.01
17Jul10	0.00	0.00
18Jul10	0.00	0.00
19Jul10	0.00	0.00
20Jul10	0.00	0.00
21Jul10	0.00	0.26
22Jul10	0.00	0.00
23Jul10	0.00	0.00
24Jul10	0.00	0.00
25Jul10	0.00	0.00
26Jul10	0.01	0.03
27Jul10	0.01	0.00
28Jul10	0.21	1.86
29Jul10	0.00	0.81
30Jul10	0.00	0.00
31Jul10	0.00	0.00
01Aug10	0.00	0.00
02Aug10	0.00	0.00
03Aug10	0.00	0.00
04Aug10	0.00	0.00
05Aug10	0.00	0.00
06Aug10	0.00	0.00
07Aug10	0.00	0.00
08Aug10	0.00	0.00
09Aug10	0.00	0.00
10Aug10	0.00	0.00

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
11Aug10	0.15	0.00
12Aug10	0.00	0.00
13Aug10	0.00	0.00
14Aug10	0.00	0.00
15Aug10	0.00	0.00
16Aug10	0.13	0.00
17Aug10	0.00	0.31
18Aug10	0.00	0.00
19Aug10	0.00	0.03
20Aug10	0.00	0.00
21Aug10	0.00	0.00
22Aug10	0.00	0.00
23Aug10	0.00	0.00

Table 6.6 Stream Channel and corridor appearance for each site sampled along Pin Oak Creek (1242L).

Site	Stream Channel Appearance	Dominant Substrate	Corridor Appearance
16401	Natural	Mud/Clay	Pasture
20385	Natural	Silt	Shrub
20563	Natural	Mud/Clay & Rip rap	Shrub
99910	Natural	Mud/Clay	Pasture
99911	Natural	Gravel & Sand	Forest

Table 6.7 Thalweg depth, stream flow type, and site accessibility during the two surveys of Pin Oak Creek (1242L).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that much of the surveyed reach was on private property. For Bank Access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
16401	300	10	0	0.69	0.69	Intermittent w/ Pools	Public*	E
20385	300	10	0	0.32	0.28	Intermittent w/ Pools	Public*	ME
20563	300	10	0	0.22	0.26	Intermittent w/ Pools	Public*	MD
99910	300	10	0	0.15	0.01	Intermittent w/ Pools	Public*	E
99911	300	10	0	0.11	0.00	Intermittent w/ Pools	Public*	E

Table 6.8 Description of surveyed stream sites along Pin Oak Creek during first survey.

Site	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Flow (cfs)	Observed Flow
16401	18.0	0.0	0.0	0.0	no flow*
20385	7.0	0.6	4.5	0.54	normal
20563	8.0	0.7	2.5	0.08	normal
99910	7.0	0.0	0.0	0.0	no flow*
99911	14.0	0.3	0.5	0.02	low

* No flowing water. There was standing water in perennial pools between portions of dry stream bed.

** Pools were too insignificant, unable to survey.

Table 6.9 Description of surveyed stream sites along Pin Oak Creek during second survey.

Site	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Flow (cfs)	Observed Flow
16401	18.0	0.6	5.0	0.0	no flow*
20385	4.5	0.6	3.0	0.06	low
20563	4.5	0.7	2.5	0.08	low
99910	0.0	0.0	0.0	0.0	dry
99911	0.0	0.0	0.0	0.0	dry

* No flowing water. There was standing water in perennial pools between portions of dry stream bed.

** Pools were too insignificant, unable to survey.

Table 6.10 Stream aesthetics along Pin Oak Creek during first survey.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
16401	Ab	C	R	brown/black	sludge	clear/scum	N	N	LP	tracks	N	N	N
20385	A	A	R	brown	fine sediment	clear	N	N	N	tracks/nests	R	R	N
20563	R	C	N	clear	fine sediment	clear	N	N	N	tracks	C	C	C
99910	Ab	R	C	brown	sludge	scum	N	N	SP	tracks	R	R	R
99911	C	R	N	clear	solids	clear	N	N	SP	tracks	N	N	N

Table 6.11 Stream aesthetics along Pin Oak Creek during second survey.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
16401	Ab	C	R	brown	sludge	clear/scum	N	N	LP	tracks	N	N	N
20385	C	R	N	brown	sludge	brown	N	N	N	tracks	N	R	R
20563	C	C	N	clear	fine sediment	clear	N	N	LP	tracks	N	R	R
99910	Ab	A	A	brown	fine sediment	scum	N	N	N	tracks	R	R	R
99911	A	A	N	NW	fine sediment	NW	N	N	N	tracks	R	R	R

Physical Description of 16401

Pin Oak Creek at Site 16401 was visited on August 9 and 23, 2010. Located southeast of Hearne, Texas, in Robertson County, this site was accessible from the right-of-way of SH 6 / US 190, but was located primarily in a private pasture with a locked gate and a “no trespass” sign. The western (right bank) riparian zone was dominated by pasture up to the water’s edge, whereas the eastern (left) bank was largely trees and shrubs several meters to > 20 m back from the stream. Access to the stream was easy, particularly on the pastured, gently sloping right bank. Figures 6.2 and 6.3 depict the general appearance of the site and water quality during each of the surveys.

The two surveys at Site 16401 were conducted only two weeks apart and conditions did not change significantly in that span. Stream widths ranged from 0.0 to 18.0 m with a typical width of 5 m (Tables 6.8 and 6.9). Average thalweg depth was 0.69 ft during both surveys (Table 6.9), but the stream was non-wadeable due to several deep pools greater than 1.2 m deep (Tables 6.12 and 6.13; Figure 6.2). The stream channel was difficult to wade even when not in the pools, because of the sludge substrate. Figures 6.2 and 6.3 illustrate the brown to black water color witnessed during both surveys (Tables 6.10 and 6.11).



Figure 6.2 Photograph of Pin Oak Creek Site 16401 taken on August 23, 2010, the upstream view of the 30-m transect, including deep pool.



Figure 6.3 Photograph of Pin Oak Creek Site 16401 taken on August 23, 2010, the upstream view of the 300-m transect with debris on the brown-black water.

Table 6.12 Pools encountered at Site 16401 during survey on August 09, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	60	18	> 1.2
Pool 2	27	6	> 1.2
Pool 3	71	7	> 1.2
Pool 4	12	5	0.90
Pool 5	38	5	> 1.2

Table 6.13 Pools encountered at Site 16401 during survey on August 23, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	60	18.0	> 1.20
Pool 2	27	6.0	> 1.20
Pool 3	71	7.0	> 1.20
Pool 4	12	5.0	0.82
Pool 5	38	5.0	0.90

Aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 6.10 and 6.11. No wild mammals or water dependent birds were observed during the two surveys but livestock had a significant presence. Cows were witnessed in the stream during the second survey. Tracks were observed during each survey. Aquatic vegetation was abundant, especially *Typha sp.* (Figure 6.3), and algae was common. No garbage was observed. No human presence or signs of recreation were observed within the reach.

Physical Description of 20385

Pin Oak Creek at Site 20385 was visited on June 29 and August 23, 2010. Located east of Hearne, Texas, in Robertson County, this site was accessible from the right-of-way of FM 2549. No fences restricted public access but the majority of the 300-m reach was on private land. The eastern riparian south of the FM 2549 had a narrower zone of forest (approximately < 10 m) compared to the western riparian (approximately 20 m). Both sides of the stream corridor beyond the riparian zone were primarily pasture. The stream was moderately easy to access due to gently-sloping banks in some locations and the absence of private property fences (Table 6.7). There were more steep and treacherous banks in other locations throughout the reach. Figures 6.4 and 6.5 depict the appearance of the site during each of the surveys.

Site 20385 was wadeable for the entire 300-m reach length with occasional log jams and a felled tree acting as moderate obstacles (Figure 6.4). Several pools were present during both surveys, but none of them exceeded 1.0 m in depth (Tables 7.14 and 7.15). Average thalweg depth decreased from 0.32 m during the first survey to 0.27 m during the second survey when some portions of the reach were very narrow (0.6 m) and shallow (< 0.2 m) (Figure 6.6). Stream widths varied from 0.6 to 7.0 m during the first survey and 0.6 to 4.5 m during the second survey (Tables 6.8 and 6.9).



Figure 6.4 Photograph of Pin Oak Creek Site 20385 taken on June 29, 2010, the downstream view of the 30-m transect including felled tree. BRA personnel in photograph.



Figure 6.5 Photograph of Pin Oak Creek Site 20385 taken on June 29, 2010, the upstream view of the 150-m transect.

Table 6.14 Pools encountered at Site 20385 during survey on June 29, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	17	4.0	0.63
Pool 2	20	7.0	0.69
Pool 3	10	5.0	0.75
Pool 4	43	4.5	0.88
Pool 5	15	4.5	0.77

Table 6.15 Pools encountered at Site 20385 during survey on August 23, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	10	4.0	0.64
Pool 2	17	3.0	0.72
Pool 3	26	4.5	0.85

Aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 6.10 and 6.11, respectively. No vertebrates were observed during either survey, but hog tracks and wallows were observed during each trip. Aquatic vegetation and algae were absent during the first survey but aquatic vegetation was common and algae rare during the second survey, probably due to diminished and stagnating flows. The water color was brown during both surveys and scum was present during the second survey. Household trash, including cans, bottles, and tires were common around the bridge from which they were apparently dumped, but trash was rare considering the full 300-m reach. No human presence or signs of recreation were observed during either survey.



Figure 6.6 Photograph of Pin Oak Creek Site 20385 taken on August 23, 2010, the downstream view of the 0-m transect showing narrow, shallow stream under low-flow conditions. BRA personnel in photograph.

Physical Description of 20563

Pin Oak Creek at Site 20563 was visited on June 28 and August 20, 2010. Located east of Hearne, Texas, in Robertson County, this site was accessible from the right-of-way at the FM 391 crossing. The site is located in a forest and shrub dominated corridor (Table 6.6 and Figure 6.7). Stream access was moderately difficult due to steep, muddy banks and occasional dense brush (Figures 6.7 and 6.8).

Site 20563 was wadeable for the entire 300-m reach length though snags in the channel could pose minor obstacles to recreation. The average thalweg depth ranged was a somewhat-shallow 0.22 m during the first survey and 0.26 m during the second survey (Tables 6.6 and 6.7). Multiple pools were present during the first survey (Table 6.16) but only one was present in August (14 m by 3 m and 0.72 m deep). All these pools were less than 1.0 m deep. The maximum width encountered was 8 m and the minimum width was 0.7 m during the first survey. The aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 6.10 and 6.11, respectively. No vertebrates were observed during the two surveys but an abundance of tracks and hog wallows indicated a large presence of wild hogs along the creek.



Figure 6.7 Photograph of Pin Oak Creek Site 20563 taken on June 28, 2010, the upstream view of the 150-m transect.



Figure 6.8 Photograph of Pin Oak Creek Site 20563 taken on August 20, 2013, the downstream view of the 300-m transect. BRA personnel in photograph.

Table 6.16 Pools encountered at Site 20563 during survey on June 28, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	23	8.0	0.55
Pool 2	23	5.0	0.39
Pool 3	12	6.0	0.60
Pool 4	20	4.0	0.60

Aquatic vegetation and algae were rare to common during the two surveys and water color was clear. According to field comments in TCEQ's SWQMIS from December 2009 and January 2010, deer carcasses were reported to have been dumped from the bridge along with household trash. During the two RUAA surveys of 2010, bottles and trash of various sizes were observed (more so during the June survey). Thus, there is some evidence the bridge is used at times as a dump site for garbage at times. Besides some garbage, no indications of human presence were found.

Physical Description of 99910

Pin Oak Creek at Site 99910 was visited on June 28 and August 20, 2010. Located northeast of Hearne, Texas, in Robertson County, this site was surrounded on all sides by forest and brush, but was accessible from the right-of-way of Pin Oak Road / CR 229. Access to the stream was easy, except for fences and brush (Figure 6.9). Flow was not observed during the two surveys and the average thalweg depth was 0.12 m. Shallow, stagnant pools were only large enough to measure during the June event (Figure 6.9). These pools were all wadeable ranging 0.06 – 0.45 m deep and 24 – 73 m in length. During the second survey the stream was mostly dry with only a few insignificant muddy puddles (Figure 6.10). No major obstructions in the stream channel were observed.

Aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 6.10 and 6.11. In August, a few cows were observed in the creek bed and bovine tracks were common during both surveys (Figures 6.9 and 6.10). No other mammals or vertebrates were observed during either survey. Aquatic vegetation was abundant in the mostly-dry channel during both surveys and terrestrial vegetation as also common during the second survey. Algae was rare in June and absent in August. The water color was brown and often covered in scum when it was present during the first survey. Trash was rare, confined mostly to the bridge area, and was comprised of bottles, cans, and some household garbage. No human presence or signs of recreation were found within the reach.



Figure 6.9 Photograph of Pin Oak Creek Site 99910 taken on June 28, 2010, the upstream view of the 30-m transect, including a portion of one pool.



Figure 6.10 Photograph of Pin Oak Creek Site 99910 taken on August 20, 2010, the upstream view of the 150-m transect.

Physical Description of 99911

Pin Oak Creek at Site 99911 was visited on June 28 and August 20, 2010. Located northeast of Hearne, Texas, in Robertson County, this site was accessible from Pin Oak Road / CR 329. The 300-m reach downstream of the road crossing runs through private land and had several fences (Figure 6.11) and posted no-trespassing signs crossing the creek. The survey reach originates from a culvert under Pin Oak Road / CR 329 (Figure 6.12) that empties into a dammed pond and flows through a forest and shrub-dominated corridor. Figures 6.12 and 6.13 depict the appearance of the site during each of the surveys.



Figure 6.11 Photograph of Pin Oak Creek Site 99911 taken on June 28, 2010, the downstream view between the 150-m and 300-m transects showing fence crossing stream channel.



Figure 6.12 Photograph of Pin Oak Creek Site 99911 taken on August 20, 2010, the upstream view at the 0-m transect. BRA personnel in photograph.



Figure 6.13 Photograph of Pin Oak Creek Site 99911 taken on August 20, 2010, the downstream view of the 30-m transect.

Flow was only present during the first survey (0.02 cfs) and the site was wadeable for the entire 300-m reach with an average thalweg depth of 0.11 m. The typical average width was only 0.5 m. The lone measurable pool during the first survey was 58 m by 14 m with a depth of 0.35 m. The site was dry during the second survey (Figure 6.13) except for a small stagnant pool at the mouth of the culvert at the upstream end of the reach (Figure 6.12). During both surveys, the shallow water depths or lack of water with the sandy substrate made walking in the stream channel easy. Several pastures and fences in the reach along with thick brush on the shores were the primary obstructions to access and wading. The dammed pond upstream of the road crossing also blocked traversing the channel to the northeast.

The aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 6.10 and 6.11. There were no mammals or vertebrates observed during either survey but tracks indicated a slight presence of livestock and hogs. Aquatic vegetation was common and algae was rare when water was present during the June survey. Water was clear in June. Aquatic vegetation and algae were absent in August. A few cans were observed near the road crossing and a couple of tires were observed in the channel (Figure 6.10), otherwise trash was absent. No evidence of recreation was observed within the reach during either survey.

Observations and Interviews

Activities Observed

No contact (primary or secondary) or noncontact recreational activities were observed by RUAA field personnel at any of the sites during the surveys nor signs of recreation.

Activities Interviewed

Interviews were conducted with five landowners within the Pin Oak Creek watershed (Table 6.17). One landowner along the lower portion of Pin Oak Creek indicated fishing a few times. No other interviewees indicated recreational activity of any kind on Pin Oak Creek within the time range of RUAA consideration. Two landowners interviewed noted insufficient water to permit recreation of any kind. Another interviewee owning property between Sites 16401 and 20385 said he was unaware of anyone using the stream for recreation. The fifth interviewee was a landowner on an unnamed tributary to Pin Oak Creek and did not reference any recreational activity specific to Pin Oak Creek.

Table 6.17 Summary of recreational activities noted in interviews for Pin Oak Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location. No recreational activities were observed during field surveys or site visits.

Site or Location	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunting	Fishing	Boating, Canoeing, Kayaking
16401	1	0,0,0	0,0,0	0,0,0	0,0,0	1,0,0	0,0,0
Between 16401 & 20385	1	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
20563							
99910							
99911							
General to Pin Oak Creek	3	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
Totals	5	0,0,0	0,0,0	0,0,0	0,0,0	1,0,0	0,0,0

Summary

RUAA surveys were conducted at five sites along Pin Oak Creek (1242L) on the days of June 28-29, 2010 and August 9, 20 and 23, 2010. The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions during both the June and August 2010 surveys (NCDC, 2014). The creek was fairly shallow with an overall thalweg depth averaging 0.27 m for the two surveys. A few significant pools were encountered that were greater than 1 m deep.

During the two surveys, there were no contact recreational activities observed by field personnel. Additionally, there were no non-contact recreational activities observed during either survey. Areas of the stream open to the public were limited to a few road crossings. Most of the creek was accessible only via private property and there were several fences crossing the stream which impeded access. While conducting the stream surveys, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds or sports fields, were encountered that would promote recreation.

Five interviews were conducted of landowners within the Pin Oak Creek watershed. Of these five interviews, only one interview indicated any recreational activity along Pin Oak Creek. Fishing was noted to occur on the lowermost portion of the creek near Site 16401, but only infrequently. Two interviews noted insufficient flows or that water was not deep enough to swim in or fish as reasons not using the stream for recreation. The recreational activity reported is summarized in Figure 6.14. Overall RUAA findings are summarized in the form below.

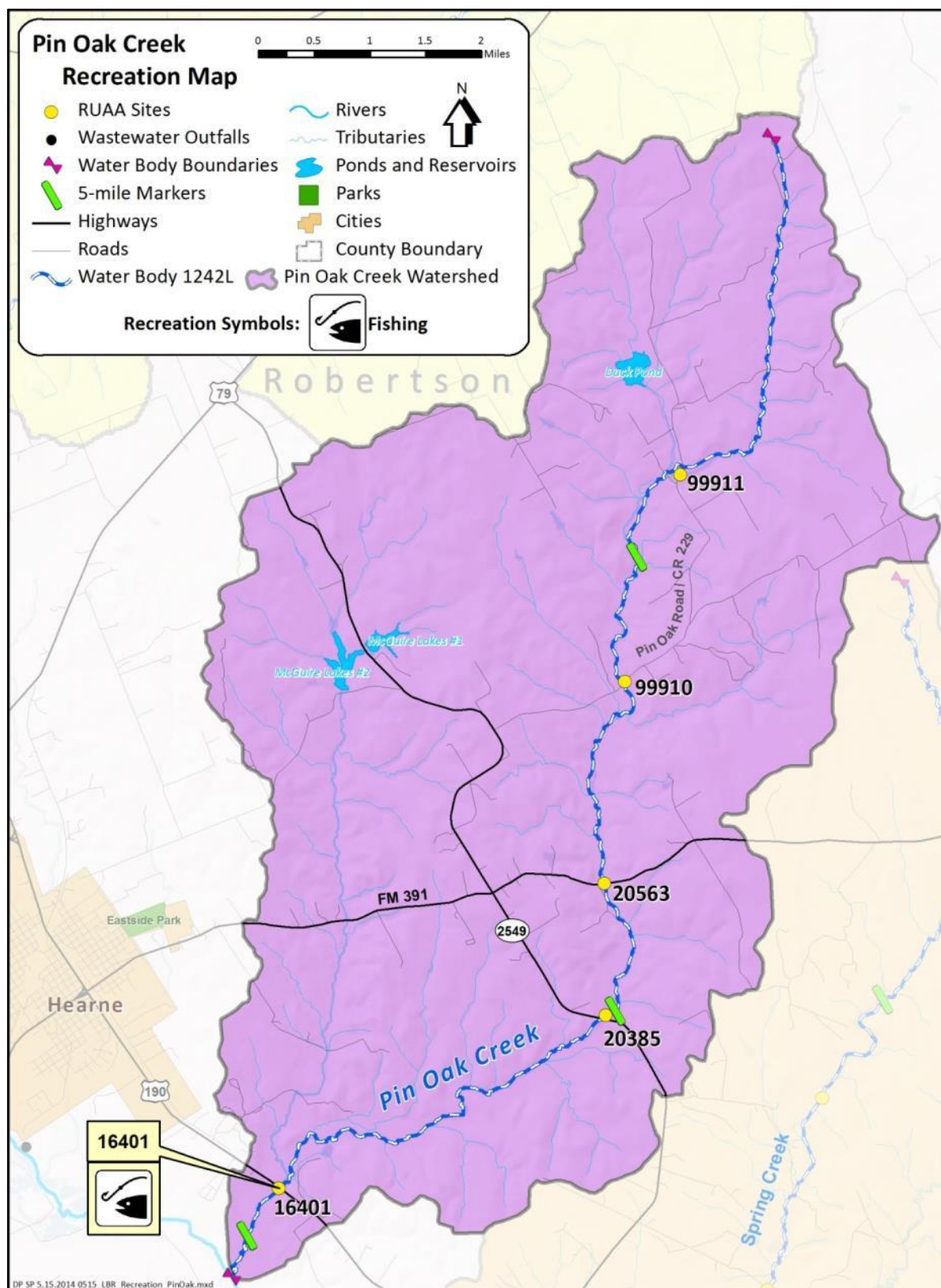


Figure 6.14 Summary of observed and interviewed recreational activities on Pin Oak Creek.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Pin Oak Creek

Segment No. of Nearest Downstream Segment No.: Segment 1242

Classified: Intermittent with pools (unclassified water body)

County: Robertson

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

b. Do secondary contact recreation 1 activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

c. Do secondary contact recreation 2 activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

d. Do noncontact recreation activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

2. Physical Characteristics of Water Body

a. What is the average thalweg depth? 0.27 meters

b. Are there substantial pools deeper than 1 meter? ☒ Yes ☐ No

c. What is the general level of public access?

☐ easy ☐ moderate ☒ very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

☐ Mild-Extreme Drought

☐ Incipient dry spell

☐ Near Normal

☐ Incipient wet spell

☒ Mild-Extreme Wet

Chapter 7

Spring Creek (1242M)

Survey Site Descriptions

Five sampling sites were established along water body 1242M for RUAA field surveys (Figure 7.1 and Table 7.2). Site 99913 was located on private property which required landowner permission to access the area. All other sites were located at public road crossings that did not require permission for access to the creek, but did require landowner cooperation to conduct the full 300-m assessment as property fences inhibited access to the Spring Creek. RUAA surveys were performed in May, June, and August of 2010. A brief description of each site follows.

Site 99912 is located on Spring Creek at Old Hearne Road, approximately 11 miles northwest of Bryan, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242M.

Site 16394 is located on Spring Creek at SH 6 / US 190, approximately 11 miles northwest of Bryan, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242M.

Site 20564 is located on Spring Creek at Jack Rabbit Lane 1.02 km south and 1.68 km east from the intersection of Jack Rabbit Lane and FM 2549 in Robertson County. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242M.

Site 99913 is located on Spring Creek at Camp Arrow Moon Road deep into private property about 1.8 miles southeast from the intersection of Camp Arrow Moon Road and FM 2549 in Robertson County. The site was selected because of the site provided opportunity for characterization of water body 1242M and no other sites with public access exist between Sites 99913 and 99914.

Site 99914 is located on Spring Creek at CR 391, approximately 4.3 mi east of the intersection of CR 391 and FM 2549 in Robertson County. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242M.

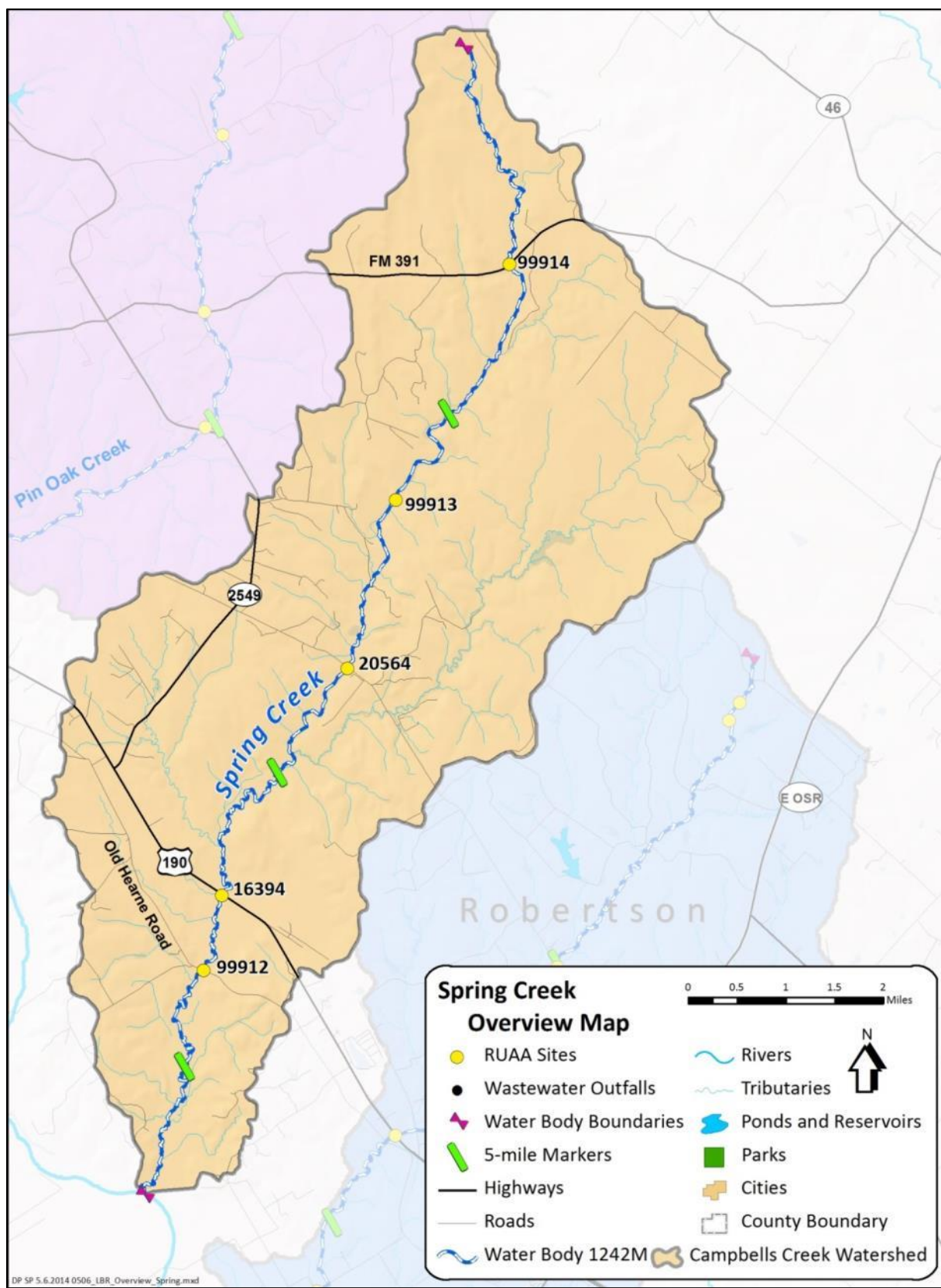


Figure 7.1 Overview of Spring Creek watershed and RUAA sites for water body 1242M.

Table 7.1 Description and location of RUAA field survey sites for Spring Creek (1242M).

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

Site ID^a	Site Description	Latitude	Longitude	Distance from Previous Site (miles)^b	Access
99912	Spring Creek at Old Hearne Road	30.7912	-96.5156	3.57 (distance to outlet)	Public
16394	Spring Creek at SH 6 / US 190	30.8022	-96.5122	1.02	Public
20564	Spring Creek at Jack Rabbit Lane southeast from the intersection of Jack Rabbit Lane and FM 2549	30.8356	-96.4897	3.94	Public
99913	Spring Creek at Camp Arrow Moon Road southeast from the intersection of Camp Arrow Moon Road and FM 2549	30.8477	-96.4855	2.04	Private
99914	Spring Creek at CR 391	30.8950	-96.4603	3.37 ^c	Public

- a. When applicable, TCEQ station identification numbers were used for RUAA site IDs. Sites with identification numbers starting with 999 were sites without recognized TCEQ station identification numbers and are specific to this project.
- b. Distances were calculated using the snap (editing) tool, followed by the split line at point (data management) tool in ArcInfo 10.0.
- c. Distance from most upstream site to beginning of assessment unit is 2.97 miles.

Field Survey Results

General Description of RUAA Survey Sites and Conditions

The Spring Creek RUAA surveys were conducted in the months of May, June and August, 2010. Air and water temperatures during both the first and second surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 7.2 and 7.3). Precipitation records for the 30 days prior to each survey are shown in Tables 7.4 and 7.5. The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions during the May, June, and August 2010 surveys (NCDC, 2014).

A summary of the RUAA field survey results is presented in the following tables:

- Table 7.6 describes the stream channel and corridor characteristics at each site.
- Table 7.7 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 7.8 and 7.9 document maximum, minimum, and average stream widths at each site for each survey as well as the flow and observed flow conditions.
- Tables 7.10 and 7.11 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each site and survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall thalweg depth averaged 0.22 m during the first survey and 0.18 m during the second survey. Depth readings at dry transects were recorded as zero. Access to the stream down the bank was easy to moderately easy at all sites but one due to low banks and the absence of impeding fences. Fine-textured substrates dominated (e.g., mud, clay, silt) and the stream corridor was largely lined with shrubs and grasses though the immediate riparian zones (within 10 m of the stream channel) were generally forest with thick underbrush. The maximum stream width encountered was 8 m during the first survey in May, June, and August 2010 and only 6 m during the second survey in August 2010. During the first survey, flow was normal at the three lower sites and the stream beds were mostly dry at the upper two sites. In August, flow of 0.16 cfs was recorded at Site 99912 (deemed normal), while flow was low at the middle sites (16394 and 20564), and the channel was dry at the upper two sites (99913 and 99914). The water surface was mostly clear with a few occasions of brown color. Scum was not observed. Tracks observed most often included cattle and hogs. Snakes were observed at three sites. Trash was rarely observed at most survey sites and when observed was predominantly typical plastics and aluminum cans. No recreation was directly observed during either of the field surveys nor were there signs of potential recreation.

Table 7.2 Air and water temperatures for each site during the first RUAA survey on Spring Creek.

Site	Date	Air Temp (°C)	Water Temp (°C)
99912	30Jun10	33.3	30.1
16394	30Jun10	27.8	25.9
20564	21May10	35.0	26.7
99913	10Aug10	33.9	NA
99914	29Jun10	29.4	29.4

Table 7.3 Air and water temperatures for each site during the second RUAA survey on Spring Creek.

Site	Date	Air Temp (°C)	Water Temp (°C)
99912	20Aug10	33.3	30.1
16394	18Aug10	27.8	25.9
20564	12Aug10	35.0	26.7
99913	18Aug10	33.9	NA
99914	18Aug10	29.4	29.4

Table 7.4 Rainfall records 30 days prior to the first RUAA survey on Spring Creek.

Survey dates vary by site with the earliest initiated on May 21, 2010. Days of surveys are highlighted in gray.

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
21Apr10	0.00	0.00
22Apr10	0.00	0.00
23Apr10	0.00	0.11
24Apr10	0.02	0.09
25Apr10	0.00	0.00
26Apr10	0.06	0.00
27Apr10	0.00	0.70
28Apr10	0.00	0.00
29Apr10	0.00	0.00
30Apr10	0.01	0.00
01May10	0.00	0.00
02May10	0.00	0.00
03May10	0.00	0.00
04May10	0.00	0.02
05May10	0.00	0.00
06May10	0.00	0.00
07May10	0.00	0.00
08May10	0.00	0.00
09May10	0.00	0.00
10May10	0.00	0.00
11May10	0.00	0.00
12May10	0.00	0.00
13May10	0.00	0.00
14May10	1.04	0.00
15May10	0.84	1.38
16May10	0.00	0.02
17May10	0.12	0.00
18May10	0.00	0.13
19May10	0.00	0.00
20May10	0.00	0.00
21May10	0.00	0.00
22May10	0.00	0.00
23May10	0.00	0.00

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
24May10	0.00	0.00
25May10	0.00	0.00
26May10	0.00	0.00
27May10	0.00	0.00
28May10	0.00	0.00
29May10	0.00	0.00
30May10	0.00	0.00
31May10	0.00	0.00
01Jun10	0.00	0.00
02Jun10	0.56	0.00
03Jun10	0.82	1.25
04Jun10	0.00	1.30
05Jun10	0.00	0.00
06Jun10	0.00	0.00
07Jun10	0.00	0.00
08Jun10	0.24	0.00
09Jun10	4.27	1.16
10Jun10	0.00	0.84
11Jun10	0.00	0.00
12Jun10	0.00	0.00
13Jun10	0.00	0.00
14Jun10	0.00	0.00
15Jun10	0.00	0.00
16Jun10	0.00	0.00
17Jun10	0.00	0.00
18Jun10	0.00	0.00
19Jun10	0.00	0.00
20Jun10	0.00	0.00
21Jun10	0.00	0.00
22Jun10	0.00	0.00
23Jun10	0.00	0.01
24Jun10	1.39	0.00
25Jun10	0.00	0.00
26Jun10	0.00	0.00
27Jun10	0.00	0.00
28Jun10	0.01	0.00

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
29Jun10	0.00	0.00
30Jun10	0.00	0.64
01Jul10	0.16	0.00
02Jul10	0.82	0.00
03Jul10	0.00	0.00
04Jul10	0.00	0.00
05Jul10	0.00	0.95
06Jul10	0.00	0.00
07Jul10	0.00	0.00
08Jul10	0.02	0.00
09Jul10	0.00	0.00
10Jul10	0.00	0.00
11Jul10	0.00	0.00
12Jul10	0.00	0.00
13Jul10	0.00	0.00
14Jul10	0.00	0.00
15Jul10	0.00	0.00
16Jul10	0.00	0.01
17Jul10	0.00	0.00
18Jul10	0.00	0.00
19Jul10	0.00	0.00
20Jul10	0.00	0.00
21Jul10	0.00	0.26
22Jul10	0.00	0.00
23Jul10	0.00	0.00
24Jul10	0.00	0.00
25Jul10	0.00	0.00
26Jul10	0.01	0.03
27Jul10	0.01	0.00
28Jul10	0.21	1.86
29Jul10	0.00	0.81
30Jul10	0.00	0.00
31Jul10	0.00	0.00
01Aug10	0.00	0.00
02Aug10	0.00	0.00
03Aug10	0.00	0.00

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
04Aug10	0.00	0.00
05Aug10	0.00	0.00
06Aug10	0.00	0.00
07Aug10	0.00	0.00
08Aug10	0.00	0.00
09Aug10	0.00	0.00
10Aug10	0.00	0.00

Table 7.5 Rainfall records 30 days prior to second RUAA surveys on Spring Creek.

Survey dates vary by site with the earliest initiated on August 12, 2010. Days of surveys are highlighted in gray.

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
12Jul10	0.00	0.00
13Jul10	0.00	0.00
14Jul10	0.00	0.00
15Jul10	0.00	0.00
16Jul10	0.00	0.01
17Jul10	0.00	0.00
18Jul10	0.00	0.00
19Jul10	0.00	0.00
20Jul10	0.00	0.00
21Jul10	0.00	0.26
22Jul10	0.00	0.00
23Jul10	0.00	0.00
24Jul10	0.00	0.00
25Jul10	0.00	0.00
26Jul10	0.01	0.03
27Jul10	0.01	0.00
28Jul10	0.21	1.86
29Jul10	0.00	0.81
30Jul10	0.00	0.00
31Jul10	0.00	0.00
01Aug10	0.00	0.00
02Aug10	0.00	0.00

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
03Aug10	0.00	0.00
04Aug10	0.00	0.00
05Aug10	0.00	0.00
06Aug10	0.00	0.00
07Aug10	0.00	0.00
08Aug10	0.00	0.00
09Aug10	0.00	0.00
10Aug10	0.00	0.00
11Aug10	0.15	0.00
12Aug10	0.00	0.00
13Aug10	0.00	0.00
14Aug10	0.00	0.00
15Aug10	0.00	0.00
16Aug10	0.13	0.00
17Aug10	0.00	0.31
18Aug10	0.00	0.00
19Aug10	0.00	0.03
20Aug10	0.00	0.00

Table 7.6 Stream Channel and corridor appearance for each site sampled along Spring Creek (1242M).

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance
99912	Natural	Sand	Pasture
16394	Natural	Sand	Forest & Shrub*
20564	Natural	Gravel & Silt	Shrub & Pasture *
99913	Natural	Silt & Mud/clay	Forest & Shrub*
99914	Natural	Mud/Clay	Shrub

*Survey 1 & 2 reflected different vegetation

Table 7.7 Thalweg depth, stream flow type, and site accessibility during the two surveys of Spring Creek (1242M).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that much of the surveyed reach was on private property. For Bank Access, E = Easy, ME = Moderately Easy, D = Difficult.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access for Trip 1	Bank Access for Trip 2
99912	300	10	0	0.37	0.23	Intermittent w/ Pools	Public*	E	E
16394	300	10	0	0.42	0.34	Intermittent w/ Pools	Public*	ME	E
20564	300	10	0	0.27	0.34	Intermittent w/ Pools	Public*	ME	ME
99913	300	10	0	0.00	0.00	Intermittent w/ Pools	Private	D	D
99914	300	10	0	0.02	0.00	Intermittent w/ Pools	Public*	E	ME

Table 7.8 Description of surveyed stream sites along Spring Creek during first survey.

Site	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Flow (cfs)	Observed Flow
99912	7.0	0.5	3.0	2.2	normal
16394	8.0	0.5	4.0	1.7	normal
20564	8.0	1.5	2.5	1.4	normal
99913	0.0	0.0	0.0	0.0	dry
99914	0.0	0.0	0.0	0.0	dry

Table 7.9 Description of surveyed stream sites along Spring Creek during second survey.

Site	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Flow (cfs)	Observed Flow
99912	6.0	0.9	2.5	0.16	normal
16394	5.0	0.7	3.0	0.07	low
20564	4.0	0.7	2.5	0.17	low
99913	0.0	0.0	0.0	0.0	dry
99914	0.0	0.0	0.0	0.0	dry

Table 7.10 Stream aesthetics along Spring Creek during first survey.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
99912	R	R	N	clear	N	clear	MP	N	LP	tracks/ fecal	R	R	R
16394	R	C	N	brown	N	clear	N	N	LP	tracks/ fecal	N	R	R
20564	C	R	N	brown	fine sediment	clear	N	N	N	N	R	R	R
99913	A	A	NW	NW	sludge	NW	N	N	N	N	N	N	N
99914	A	A	N	black	fine sediment	clear	N	N	SP	N	N	N	N

Table 7.11 Stream aesthetics along Spring Creek during second survey.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
99912	C	R	N	clear/ green	fine sediment	clear	SP	N	N	tracks	R	C	C
16394	R	R	N	clear	fine sediment	clear	SP	N	N	tracks	N	N	N
20564	Ab	C	N	clear	fine sediment	clear	N	N	N	tracks	N	N	N
99913	A	A	NW	NW	fine sediment	NW	SP	N	N	tracks/ nests	N	N	N
99914	A	A	NW	NW	fine sediment	NW	N	N	SP	tracks	N	N	N

Physical Description of 99912

Spring Creek at Site 99912 was visited on June 30 and August 20, 2013. Located southeast of Hearne, Texas, in Robertson County, this site was accessible from the right-of-way of Old Hearne Road but was located primarily in a fenced private pasture. Both banks were vegetated with trees and shrubs usually only 10 - 20 m back from the stream with pasture dominating the area beyond the immediate riparian corridor. Access to the stream was easy. Figures 7.2 and 7.3 depict the general appearance of the site and water quality during each of the surveys.

Conditions did not change significantly between the two surveys. Stream widths ranged from 0.5 - 7.0 m with a typical width of 3 m during the first survey and 0.9 - 6 m with a typical width of 2.5 m during the second survey (Tables 7.8 and 7.9). The stream was wadeable for the entire 300-m reach length except for within one pool encountered during both surveys that had a depth which exceeded 1.2 m. Three pools were encountered during the first survey and two during the second (Tables 7.12 and 7.13). Occasional log jams and a fence near the 150-m transect obstructed passage through the creek (Figure 7.4). The average thalweg depth was 0.37 during the first survey and 0.23 during the second survey. Water was clear during both surveys. Sludge and fine sediments were present during the second survey (Tables 7.10 and 7.11).



Figure 7.2 Photograph of Spring Creek Site 99912 taken on June 30, 2010, the upstream view of the 150-m transect.



Figure 7.3 Photograph of Spring Creek Site 99912 taken on August 20, 2010, the upstream view of the 300-m transect. BRA personnel in photograph.

Table 7.12 Pools encountered at Site 99912 during survey on June 30, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	12	5	1.3
Pool 2	18	7	1.2
Pool 3	17	4	0.85

Table 7.13 Pools encountered at Site 99912 during survey on August 20, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	11	6	> 1.2
Pool 2	61	4	0.74



Figure 7.4 Photograph of Spring Creek Site 99912 taken on June 30, 2010, the downstream view of the 150-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 7.11 and 7.12. During the first survey livestock presence was large, feral hogs were moderately present, and other wild mammals were only briefly observed. During the second survey, no wild or domesticated mammals were observed but cattle tracks to the creek were abundant. Among other vertebrates, snakes were observed during both surveys (three in August). Water-dependent birds were never observed. Aquatic vegetation was rare in June and common in August, especially around the bridge. During both surveys algae was rare, odor was absent, and the water was clear. Large garbage was rare in June and August but small garbage, which was rare in June, was common in August and included a TV and household trash dropped from the bridge. No human presence or signs of recreation were observed within the reach during either survey.

Physical Description of 16394

Spring Creek at Site 16394 was visited on June 30 and August 18, 2010. Located southeast of Hearne, Texas, in Robertson County, this site was accessible from the right-of-way of SH 6 / US 190. Public access was not difficult except for a barbed-wire fence on the upstream side of the bridge (Table 7.7). The majority of the 300-m reach was on pastured private land with a forested riparian of approximately 0 – 20 m. Banks had mostly gentle slopes throughout the reach, but a few were more steep and treacherous. Figures 7.5 and 7.6 depict the appearance of the site during each of the surveys.



Figure 7.5 Photograph of Spring Creek Site 16394 taken on June 30, 2010, the upstream view of the 30-m transect. BRA personnel in photograph.



Figure 7.6 Photograph of Spring Creek Site 20385 taken on June 30, 2010, the downstream view of the 300-m transect.

Site 16394 was wadeable for the entire 300-m reach length. Average thalweg depth decreased from 0.42 m during the first survey to 0.34 m during the second survey. Stream widths varied from 0.5 to 8.0 m during the first survey and 0.7 to 5.0 m during the second survey (Tables 7.8 and 7.9). In addition to shallow depths, the general lack of instream obstructions (such as felled trees) accommodated wading. At the 30-m transect, a barbed-wire fence had snagged large woody material, creating an obstruction in the creek. A single pool was measured that was 46 m long, 8 m wide, and 1.1 m deep during the first survey in June. This same pool was 59 m long, 5 m wide, and 0.75 m in depth during the second survey in August. Soft mud near to the SH 6 / US 190 bridge gave way to firmer but fine sediments more upstream from the bridge.

Aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 7.10 and 7.11, respectively. There was a large presence of feral hogs, a moderate presence of livestock, and a slight presence of other wild mammals observed during the first survey along with tracks and fecal droppings. During the second survey only tracks were noted and no mammals were observed. A single snake was observed in August but no other non-mammalian vertebrates were observed during either survey. Aquatic vegetation was rare during both surveys and algae went from common to rare between June and August. The water color was brown during the first survey but clear during the second. Household trash was small, rare, and only observed during the first survey. No human presence or signs of recreation were observed during either survey.

Physical Description of 20564

Spring Creek at Site 20564 was visited on May 21 and August 12, 2010. Located southeast of Hearne, Texas, in Robertson County, this site was accessible from the right-of-way at the Jack Rabbit Lane crossing. The site is located in a shrub and pasture-dominated corridor with a wooded riparian zone containing many bald cypress trees (Table 7.6 and Figure 7.7). The knees of the bald cypress might be considered obstructions to boating and some other types of recreation during lower flow conditions. Stream access was moderately easy due to gentle slopes but the private property on which most of the 300-m reach was located, was fenced on both sides of the Jack Rabbit crossing. Signs of upwelling sands and springs were present (Figure 7.8) and the reach was prone to long-lasting seeping after rains leading to marshy conditions. Figures 7.7 and 7.9 depict the general appearance of the site during each of the surveys.

Site 20564 was wadeable for the entire 300-m reach length though culverts at the bridge, fences, and thick vegetation made it difficult to traverse the channel at a few points. Three pools were present in May that measured 1.2 m to 1.3 m deep (Table 7.14). In August, only one pool was present and it measured 10 m long, 2.75 m wide, and 0.75 m deep. Measurements of the narrowest and widest points in the reach were 1.5 m to 8.0 m in May and 0.7 m to 4.0 m in August. The average thalweg depth ranged from 0.27 m during the first survey to 0.34 m during the second survey (Tables 7.8 and 7.9). Substrate was fine sediment during both surveys.

Table 7.14 Pools encountered at Site 20564 during survey on May 21, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	17	8	1.2
Pool 2	10	4	1.3
Pool 3	16	5	1.2

The aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 7.10 and 7.11, respectively. No vertebrates were observed during the two surveys but unidentified tracks were observed in August. In May aquatic vegetation was common, algae was rare, and water color was brown. During the second survey aquatic vegetation was abundant, algae was common, and water color was clear. Garbage was only observed during the first survey and consisted of buckets dumped near the culvert at Jack Rabbit Lane. No human presence, beyond survey personnel, was observed within the reach.



Figure 7.7 Photograph of Spring Creek Site 20564 taken on May 21, 2010, the downstream view of the 30-m transect.



Figure 7.8 Photograph of sandy upwelling on Spring Creek Site 20564 taken on August 12, 2010.



Figure 7.9 Photograph of Spring Creek Site 20564 taken on August 12, 2010, the upstream view of the 150-m transect.

Physical Description of 99913

Spring Creek at Site 99913 was visited on August 10 and August 18, 2010. Located east of Hearne, Texas, in Robertson County, this site was accessible from private property near the Arrow Moon Road crossing of Spring Creek. In addition to a locked gate, extremely dense brush and thorny vines made access to the stream channel difficult. No water was observed during the two surveys. If water were present, the 300-m reach would be wadeable with exposed roots and a few felled trees as the only significant obstacles. Figures 7.10 and 7.11 depict the general appearance of the site during each of the surveys.

Aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 7.10 and 7.11. The only signs of animals were tracks, bird nests, and a garter snake in the dry creek bed on August 18, 2010. No trash was observed during the two surveys. Because the stream was completely dry during surveys, no aquatic vegetation or algae was observed. No evidence of human presence was found within the reach.



Figure 7.10 Photograph of dense brush at Spring Creek Site 99913 taken on August 18, 2010, the downstream view of the 0-m transect.

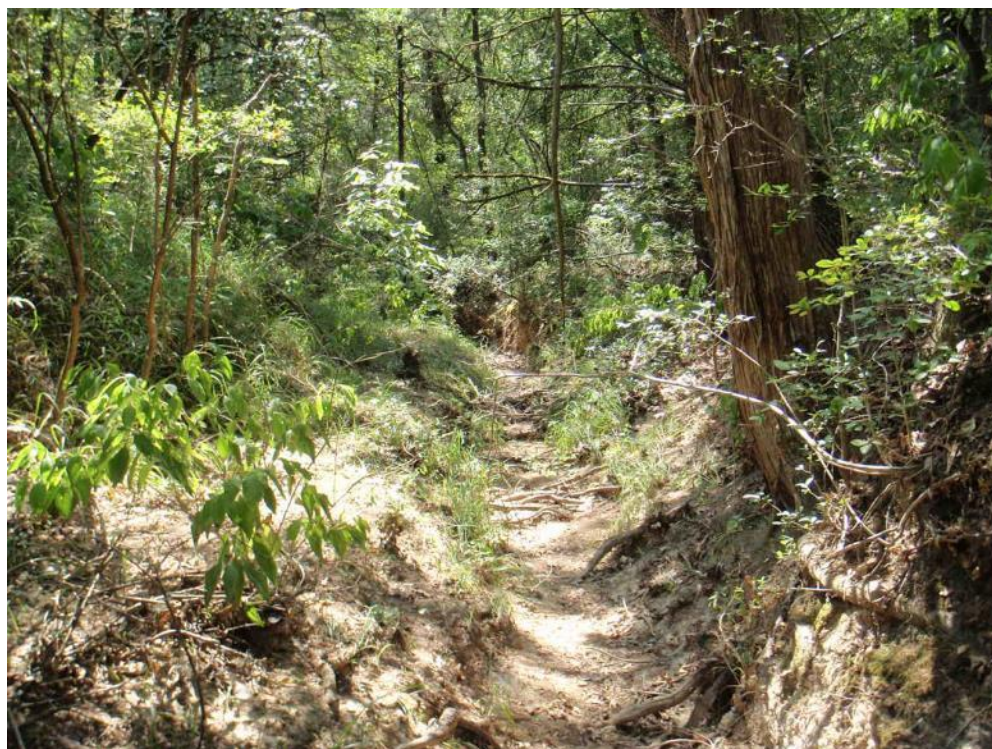


Figure 7.11 Photograph of Spring Creek Site 99913 taken on August 18, 2010, the upstream view of the 150-m transect.

Physical Description of 99914

Spring Creek at Site 99914 was visited on June 29 and August 18, 2010. Located northeast of Hearne, Texas, in Robertson County, this site was accessible from the right-of-way of FM 391. A culvert was the only sign of the creek's existence (Figures 7.12) which was almost entirely dry in June and completely dry in August. The average thalweg depth during the June survey 0.02 m. The 300-m reach was located downstream of the road crossing on private property and was not fenced. A fence was constructed on the upstream side of the road crossing between surveys. Terrestrial vegetation was thick in the channel in places and would be the only considerable obstacle to wading if water were present. Figures 7.13 and 7.14 depict the appearance of the site during each of the surveys.

Water was only present during the first survey and it was in the form of shallow pools (0.17 m in depth at the 30-m transect). The dimensions of the pools were too insignificant to measure. Thick brush and vines are the primary obstructions to access.

The aesthetic appearance of the creek bed and wildlife observations for the site during each survey are provided in Tables 7.10 and 7.11. One deer was spotted during each survey and tracks were observed in August, but this was the only evidence of animals recorded. Trash was absent on both survey dates. No evidence of recreation was observed within the reach.



Figure 7.12 Photograph of Spring Creek Site 99914 taken on June 29, 2010, showing the dry and grassy creek bed at the downstream side of the FM 391 crossing. BRA personnel in photograph.



Figure 7.13 Photograph of Spring Creek Site 99914 taken on June 29, 2010, the downstream view at the 30-m transect. BRA personnel in photograph.



Figure 7.14 Photograph of Spring Creek Site 99914 taken on August 18, 2010, the downstream view of the 150-m transect. BRA personnel in photograph.

Observations and Interviews

Activities Observed

No contact (primary or secondary) or noncontact recreational activities were observed by RUAA field personnel at any of the sites during the surveys nor was there evidence of possible recreation.

Activities Interviewed

A single interview was conducted with a volunteer at Camp Arrowmoon, a Boy Scout facility located southwest of Site 99913 off of Camp Arrowmoon Road (Table 7.15). She had never recreated in the stream, had never observed others recreating in the stream, nor was aware of others recreating in the stream. She said the scouts staying at the camp were not permitted to enter the stream as they would have to trespass on private property to do so. While parts of Camp Arrowmoon are with a few thousand feet of Spring Creek, there is private property between Camp Arrowmoon and the creek.

Table 7.15 Summary of recreational activities noted in interviews for Spring Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location. No recreational activities were observed during field surveys or site visits.

Site	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunting	Fishing	Boating, Canoeing, Kayaking
99912							
16394							
20564							
99913	1	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
99914							
Totals	1	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0

Summary

RUAA surveys were conducted at five sites along Spring Creek (1242M). The first survey was conducted on May 21, June 29-30, and August 10, 2010. The second survey was conducted on August 12, 18, and 20, 2010. The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions during the May, June, and August 2010 surveys (NCDC, 2014). In some portions of the reach, there was no water to allow any form of water recreation and what water was present was fairly shallow. The overall thalweg depth was 0.20 meters, although a few significant pools greater than 1 m deep were encountered.

During the two surveys, there were no contact recreational activities observed by field personnel. Additionally, there were no non-contact recreational activities observed during either survey. While conducting the stream surveys, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds or sports fields, were encountered along the creek that would promote recreation. The Boy Scout Camp within the Spring Creek watershed does not border the creek and an interview with a volunteer from the camp indicated that the boys at the camp are not allowed to access the creek as they would have to cross private property.

Areas of the stream open to the public are limited to the right-of-way areas immediately underneath the bridge crossings or areas immediately up and down stream of culvert crossings, which often has private property fences obstructing access. Most of the land along Spring Creek is private property requiring landowner permission for access.

There was one interview submitted by a landowner in relationship to Site 99913 who stated that there was no recreation along the creek within their property.

A recreational activity map is not provided for Spring Creek as no forms of recreation were observed or noted in interviews for this water body.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Spring Creek

Segment No. of Nearest Downstream Segment No.: Segment 1242

Classified: Intermittent with pools (unclassified water body)

County: Robertson

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

b. Do secondary contact recreation 1 activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

c. Do secondary contact recreation 2 activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

d. Do noncontact recreation activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

2. Physical Characteristics of Water Body

a. What is the average thalweg depth? 0.20 meters

b. Are there substantial pools deeper than 1 meter? ☒ Yes ☐ No

c. What is the general level of public access?

☐ easy ☐ moderate ☒ very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

☐ Mild-Extreme Drought

☐ Incipient dry spell

☐ Near Normal

☐ Incipient wet spell

☒ Mild-Extreme Wet

Chapter 8

Campbells Creek (1242I)

Survey Site Descriptions

Five RUAA sampling sites were established along water body 1242I (Figure 8.1 and Table 8.1). Three sites were located at public road crossings that did not require permission for access to the creek, but did require landowner cooperation to conduct the full 300-m assessment. Access to the creek at these three road crossing was limited by private property fencing. RUAA surveys were performed in June and August of 2010. A brief description of each site follows.

Site 99915 is located on Campbells Creek at Mumford Benchley Road, approximately 5 miles northwest of Bryan, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242I.

Site 16395 is located on Campbells Creek at SH 6 / US 190, approximately 14 miles south of Hearne, Texas. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242I.

Site 20561 is located on Campbells Creek at Jack Rabbit Lane 2.25 km north and 1.3 km west from the intersection of Jack Rabbit Lane and East Old San Antonio Road / County Line Road in Robertson County. The site was selected because of public accessibility at the bridge crossing and the site provided opportunity for characterization of water body 1242I.

Site 99916 is located on Campbells Creek at a private road, approximately 1 mile west and 0.1 miles south of the intersection of Old San Antonio Road / County Line Road and Castenson Road in Robertson County. The site was selected because the site provided opportunity for characterization of water body 1242I.

Site 99917 is located on Campbells Creek at a private road, approximately 0.8 miles northwest of the intersection of Old San Antonio Road / County Line Road and Box S Ranch Road in Robertson County. The site was selected because the site provided opportunity for characterization of water body 1242I.

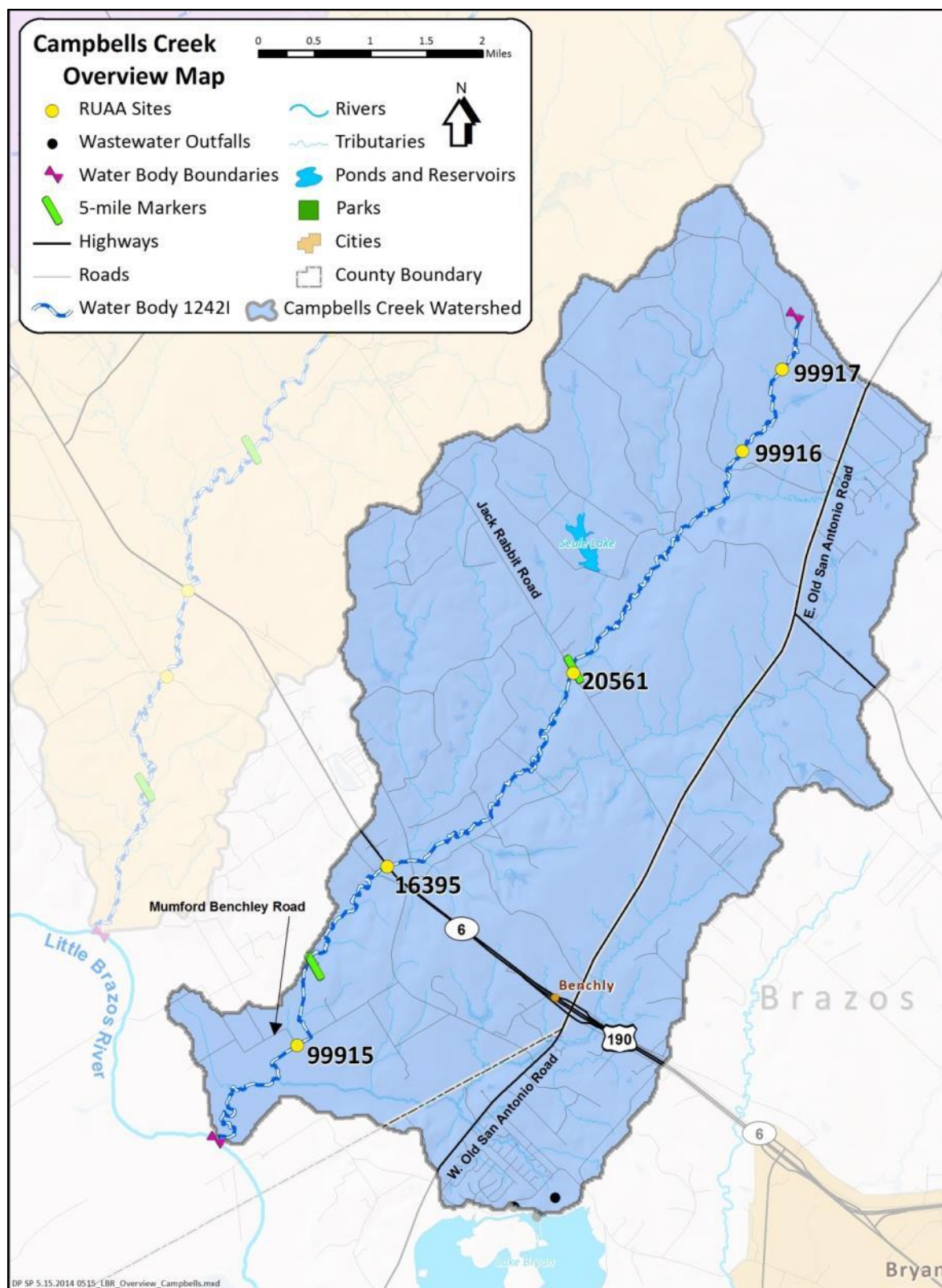


Figure 8.1 Overview of Campbells Creek watershed and RUAA sites for water body 1242I.

Table 8.1 Description and location of RUAA field survey sites for Campbells Creek (1242I).

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

Site ID ^a	Site Description	Latitude	Longitude	Distance from Previous Site (miles) ^b	Access
99915	Campbells Creek at Mumford Benchley Road	30.7431	-96.4974	1.90 (dist. to outlet)	Public*
16395	Campbells Creek SH 6 / US 190	30.7660	-96.4832	2.53	Public*
20561	Campbells Creek at Jack Rabbit Lane	30.7905	-96.4547	3.35	Public*
99916	Campbells Creek at Private Road 1 miles west of intersection of Old San Antonio Road / County Line Road and Castenson Road	30.8187	-96.4286	3.33	Private
99917	Campbells Creek at Private Road 0.8 miles west of intersection of Old San Antonio Road / County Line Road and Box S Ranch Road	30.8347	-96.4199	1.06	Private

- When applicable, TCEQ station identification numbers were used for RUAA site IDs. Sites with identification numbers starting with 999 were sites without recognized TCEQ station identification numbers and are specific to this project.
- Distances were calculated using the snap (editing) tool, followed by the split line at point (data management) tool in ArcInfo 10.0.
- Distance from most upstream site to beginning of assessment unit is 0.65 miles.

Field Survey Results

General Description of RUAA Survey Sites and Conditions

The Campbells Creek RUAA surveys were conducted in the months of April, May, June, and August, 2010. TCEQ guidance for RUAA's recommends air temperatures during surveys to exceed 21°C (70°F) because these temperatures promote recreational activities (TCEQ, 2014). On April 9, 2010, when Sites 99915 and 16395 were first surveyed, the air temperatures ranged 17.5 – 18.1°C (63.5 – 64.6°F), respectively (Tables 8.2 and 8.3). All other survey dates, ranging from May 21 – August 31, 2010, were above 21°C (70°F). Precipitation records for the 30 days prior to each survey are shown in Tables 8.4 and 8.5. The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions for April through August 2010 for the watershed area (NCDC, 2014).

A summary of the RUAA field survey results is presented in the following tables:

- Tables 8.6 describes the stream channel and corridor characteristics at each site.
- Table 8.7 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 8.8 and 8.9 document the maximum, minimum, and average stream widths at each site for each survey as well as the flow and observed flow conditions.
- Tables 8.10 and 8.11 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each site and survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall thalweg depth averaged 0.26 m during the first survey and 0.16 m during the second survey. Depth readings at dry transects were recorded as zero. Access to the stream down the bank was moderately easy in most locations due to low banks and the absence of impeding fences. Fine-textured substrates dominated (e.g., mud, clay, and silt). The stream corridor was largely lined with shrubs and pasture, although the immediate riparian zones (within 10 m of the stream channel) were generally forest with thick underbrush. The maximum stream width encountered was 6 m during the first survey and 4.5 m during the second survey. During the first survey, flow was negligible to nonexistent at the upper two sites, 99916 and 99917, both normal conditions for those locations. At the lower three sites, 99915, 16395, and 20561, flows were near or less than 1 cfs during the first survey, which was deemed normal for that portion of the creek. During the second survey, lower flow conditions were encountered. The water surface varied from clear to brown during the first survey to brown/black with occasional scum on stagnant pools during the second survey. Tracks observed most often included cattle and hogs. Trash was abundant to common at the lower three survey sites and generally rare to none at the upper two survey sites. When observed, the trash consisted primarily of tires and household garbage. No recreation was directly observed during either of the field surveys nor were there signs of potential recreation.

Table 8.2 Air and water temperatures for each site during the first RUAA survey on Campbells Creek.

Site	Date	Air Temp (°C)	Water Temp (°C)
99915	09Apr10	17.5	15.2
16395	09Apr10	18.1	15.3
20561	21May10	31.0	24.0
99916	23Jun10	33.3	26.3
99917	09Aug10	32.2	NA

Table 8.3 Air and water temperatures for each site during the second RUAA survey on Campbells Creek.

Site	Date	Air Temp (°C)	Water Temp (°C)
99915	12Aug10	33.3	NA
16395	12Aug10	29.4	26.7
20561	31Aug10	28.3	NA
99916	24Aug10	30.0	25.8
99917	24Aug10	30.0	NA

Table 8.4 Rainfall records 30 days prior to the first RUAA survey on Campbells Creek.

Survey dates vary by site with the earliest initiated on April 9, 2010. Days of surveys are highlighted in gray. Rainfall records prior to the first survey of Site 99917 on August 9, 2010 visit are covered in Table 8.5.

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
9-Mar-2010	0.11	0.53
10-Mar-2010	0.00	0.00
11-Mar-2010	0.00	0.00
12-Mar-2010	0.00	0.00
13-Mar-2010	0.00	0.00
14-Mar-2010	0.00	0.00
15-Mar-2010	0.00	0.00
16-Mar-2010	0.53	0.03
17-Mar-2010	0.00	0.61
18-Mar-2010	0.00	0.00
19-Mar-2010	0.00	0.00
20-Mar-2010	0.89	0.00
21-Mar-2010	0.00	0.51
22-Mar-2010	0.00	0.00
23-Mar-2010	0.00	0.00
24-Mar-2010	0.38	0.00
25-Mar-2010	0.04	0.44
26-Mar-2010	0.00	0.00
27-Mar-2010	0.00	0.00
28-Mar-2010	0.00	0.00
29-Mar-2010	0.00	0.00
30-Mar-2010	0.00	0.00
31-Mar-2010	0.00	0.00
1-Apr-2010	0.00	0.00
2-Apr-2010	0.00	0.00
3-Apr-2010	0.04	0.00
4-Apr-2010	0.00	0.18
5-Apr-2010	0.00	0.00
6-Apr-2010	0.00	0.00
7-Apr-2010	0.03	0.00
8-Apr-2010	0.00	0.00
9-Apr-2010	0.00	0.00
10-Apr-2010	0.00	0.00
11-Apr-2010	0.00	0.00

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
12-Apr-2010	0.00	0.00
13-Apr-2010	0.00	0.00
14-Apr-2010	0.02	0.00
15-Apr-2010	0.07	0.01
16-Apr-2010	0.04	0.00
17-Apr-2010	0.22	0.00
18-Apr-2010	0.57	0.33
19-Apr-2010	0.01	0.38
20-Apr-2010	0.00	0.00
21-Apr-2010	0.00	0.00
22-Apr-2010	0.00	0.00
23-Apr-2010	0.00	0.11
24-Apr-2010	0.02	0.09
25-Apr-2010	0.00	0.00
26-Apr-2010	0.06	0.00
27-Apr-2010	0.00	0.70
28-Apr-2010	0.00	0.00
29-Apr-2010	0.00	0.00
30-Apr-2010	0.01	0.00
1-May-2010	0.00	0.00
2-May-2010	0.00	0.00
3-May-2010	0.00	0.00
4-May-2010	0.00	0.02
5-May-2010	0.00	0.00
6-May-2010	0.00	0.00
7-May-2010	0.00	0.00
8-May-2010	0.00	0.00
9-May-2010	0.00	0.00
10-May-2010	0.00	0.00
11-May-2010	0.00	0.00
12-May-2010	0.00	0.00
13-May-2010	0.00	0.00
14-May-2010	1.04	0.00
15-May-2010	0.84	1.38
16-May-2010	0.00	0.02
17-May-2010	0.12	0.00
18-May-2010	0.00	0.13
19-May-2010	0.00	0.00

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
20-May-2010	0.00	0.00
21-May-2010	0.00	0.00
22-May-2010	0.00	0.00
23-May-2010	0.00	0.00
24-May-2010	0.00	0.00
25-May-2010	0.00	0.00
26-May-2010	0.00	0.00
27-May-2010	0.00	0.00
28-May-2010	0.00	0.00
29-May-2010	0.00	0.00
30-May-2010	0.00	0.00
31-May-2010	0.00	0.00
1-Jun-2010	0.00	0.00
2-Jun-2010	0.56	0.00
3-Jun-2010	0.82	1.25
4-Jun-2010	0.00	1.30
5-Jun-2010	0.00	0.00
6-Jun-2010	0.00	0.00
7-Jun-2010	0.00	0.00
8-Jun-2010	0.24	0.00
9-Jun-2010	4.27	1.16
10-Jun-2010	0.00	0.84
11-Jun-2010	0.00	0.00
12-Jun-2010	0.00	0.00
13-Jun-2010	0.00	0.00
14-Jun-2010	0.00	0.00
15-Jun-2010	0.00	0.00
16-Jun-2010	0.00	0.00
17-Jun-2010	0.00	0.00
18-Jun-2010	0.00	0.00
19-Jun-2010	0.00	0.00
20-Jun-2010	0.00	0.00
21-Jun-2010	0.00	0.00
22-Jun-2010	0.00	0.00
23-Jun-2010	0.00	0.01

Table 8.5 Rainfall records 30 days prior to second RUAA survey on Campbells Creek.

Survey dates vary by site with the earliest initiated on August 20, 2010. Days of surveys are highlighted in gray. Records begin on July 09, 2010 to cover the rainfall antecedent to the first survey of Site 99917 conducted on August 09, 2010.

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
9-Jul-2010	0.00	0.00
10-Jul-2010	0.00	0.00
11-Jul-2010	0.00	0.00
12-Jul-2010	0.00	0.00
13-Jul-2010	0.00	0.00
14-Jul-2010	0.00	0.00
15-Jul-2010	0.00	0.00
16-Jul-2010	0.00	0.01
17-Jul-2010	0.00	0.00
18-Jul-2010	0.00	0.00
19-Jul-2010	0.00	0.00
20-Jul-2010	0.00	0.00
21-Jul-2010	0.00	0.26
22-Jul-2010	0.00	0.00
23-Jul-2010	0.00	0.00
24-Jul-2010	0.00	0.00
25-Jul-2010	0.00	0.00
26-Jul-2010	0.01	0.03
27-Jul-2010	0.01	0.00
28-Jul-2010	0.21	1.86
29-Jul-2010	0.00	0.81
30-Jul-2010	0.00	0.00
31-Jul-2010	0.00	0.00
1-Aug-2010	0.00	0.00
2-Aug-2010	0.00	0.00
3-Aug-2010	0.00	0.00
4-Aug-2010	0.00	0.00
5-Aug-2010	0.00	0.00
6-Aug-2010	0.00	0.00
7-Aug-2010	0.00	0.00
8-Aug-2010	0.00	0.00
9-Aug-2010	0.00	0.00
10-Aug-2010	0.00	0.00
11-Aug-2010	0.15	0.00

DATE	COLLEGE STATION EASTERWOOD FIELD TX US GHCND:USW00003904 (in.)	FRANKLIN TX US GHCND:USC00413321 (in.)
12-Aug-2010	0.00	0.00
13-Aug-2010	0.00	0.00
14-Aug-2010	0.00	0.00
15-Aug-2010	0.00	0.00
16-Aug-2010	0.13	0.00
17-Aug-2010	0.00	0.31
18-Aug-2010	0.00	0.00
19-Aug-2010	0.00	0.03
20-Aug-2010	0.00	0.00
21-Aug-2010	0.00	0.00
22-Aug-2010	0.00	0.00
23-Aug-2010	0.00	0.00
24-Aug-2010	0.00	0.00
25-Aug-2010	0.00	0.00
26-Aug-2010	0.00	0.00
27-Aug-2010	0.00	0.00
28-Aug-2010	0.00	0.00
29-Aug-2010	0.00	0.00
30-Aug-2010	0.05	0.00
31-Aug-2010	0.00	0.01

Table 8.6 Stream Channel and corridor appearance for each site sampled along Campbells Creek (1242I).

Site	Stream Channel Appearance	Dominant Substrate	Corridor Appearance
99915	Natural	Mud/Clay and Gravel	Forest/Shrub & Pasture
16395	Natural	Mud/Clay and Gravel	Pasture
20561	Natural	Sand	Pasture
99916	Natural	Sand	Pasture
99917	Natural	Mud/Clay	Pasture

Table 8.7 Thalweg depth, stream flow type, and site accessibility during the two surveys of Campbells Creek (1242I).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that much of the surveyed reach was on private property. For Bank Access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access for Trip 1	Bank Access for Trip 2
99915	300	10	0	0.47	0.17	Intermittent	Public*	MD	ME
16395	300	10	0	0.35	0.37	Intermittent	Public*	MD	ME
20561	300	10	0	0.25	0.12	Intermittent	Public*	ME	ME
99916	300	10	0	0.21	0.30	Intermittent	Private	ME	MD
99917	300	10	0	0.00	0.00	Intermittent	Private	E	E

Table 8.8 Description of surveyed stream sites along Campbells Creek during first survey.

Site	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Flow (cfs)	Observed Flow
99915	4.0	0.9	3.0	1.0	normal
16395	6.0	1.0	4.0	0.9	normal
20561	2.3	0.7	1.5	0.2	normal
99916	4.0	0.3	2.0	0.04	normal
99917	0.0	0.0	0.0	0.0	dry

Table 8.9 Description of surveyed stream sites along Campbells Creek during second survey.

Site	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Flow (cfs)	Observed Flow
99915	4.0	0.0	2.5	0.0	no flow*
16395	4.5	0.5	4.0	<0.05	normal
20561	0.5	0.0	0.0	0.0	no flow*
99916	3.0	0.2	1.0	<0.05	low
99917	0.0	0.0	0.0	0.0	dry

*No flowing water. Water stood in perennial pools between portions of dry stream bed.

Table 8.10 Stream aesthetics along Campbells Creek during first survey.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
99915	R	R	C	brown	fine sediment	clear	N	SP	SP	tracks/fecal	Ab	C	R
16395	R	A	R	brown	fine sediment	clear	N	SP	N	tracks, fecal & nests	C	R	R
20561	R	R	N	brown	fine sediment	clear	N	N	LP	tracks/fecal	C	C	C
99916	A	R	N	clear	N	clear	N	N	SP	tracks/fecal	R	N	R
99917	Ab	C	N	clear	sludge	clear	N	N	MP	tracks/fecal	N	N	N

Table 8.11 Stream aesthetics along Campbells Creek during second survey.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
99915	A	C	Ab	brown	sludge	scum	N	N	N	tracks	Ab	Ab	Ab
16395	R	R	R	brown	fine sediment & sludge	clear/scum	N	N	N	tracks	Ab	Ab	R
20561	A	R	Ab	brown/black	fine sediment	scum	N	N	N	tracks	Ab	C	R
99916	A	R	C	clear	fine sediment	clear	N	N	N	tracks	C	R	N
99917	A	A	N	NW	NW	NW	N	N	LP	N	N	N	N

Physical Description of 99915

Campbells Creek at Site 99915 was visited on April 9 and August 12, 2010. Located southeast of Hearne, Texas, in Robertson County, this site was accessible from the right-of-way of Mumford Benchley Road but was located primarily within a fenced private pasture. The riparian zone of both banks was narrow, generally 5 - 20 m. Access to the stream was considered moderately easy during the second survey due to road access but moderately difficult during the first survey due to fencing and steep banks. Figures 8.2 and 8.3 depict the general appearance of the site and water quality during each of the surveys.

Site 99915 was flowing (1.0 cfs) on April 9, but only isolated pools were present during the second survey on August 12. Stream widths ranged from 0.9 m to 4.0 m with a typical width of 3 m during the first survey and ranged 2.5 – 4.0 m with a typical average width of 2.5 m during the second survey (Tables 8.8 and 8.9). With predominately gravel substrate and shallow average thalweg depths (0.47 m in April, 0.17 m in August) the stream was wadeable for the entire 300-m reach length except for occasional log jams that made the channel difficult to traverse at some points (Figure 8.2). Six pools large enough for recreation were measured during the first survey but only two pools were present during the second survey (Tables 8.12 and 8.13). Figures 8.3 and 8.4 illustrate the general appearance of the stream channel including the brown water color witnessed during the first survey (Tables 8.10 and 8.11).



Figure 8.2 Photograph of Campbells Creek Site 99915 taken on April 9, 2010, showing log jam near the 150-m transect.

Table 8.12 Pools encountered at Site 99915 during survey on April 9, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	19	3.0	0.61
Pool 2	57	4.0	0.67
Pool 3	26	11	1.0
Pool 4	19	3.0	0.64
Pool 5	30	2.5	0.64
Pool 6	35	4.0	0.88

Table 8.13 Pools encountered at Site 99915 during survey on August 12, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	18	3.0	0.51
Pool 2	10	4.0	0.56



Figure 8.3 Photograph of Campbells Creek Site 99915 taken on April 09, 2010, the downstream view of the 30-m transect.



Figure 8.4 Photograph of Campbells Creek Site 99915 taken on August 12, 2010, the upstream view of the 150-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 8.10 and 8.11. During the spring survey when water was present, there was a slight presence of water dependent birds, a squirrel was seen, and tracks and fecal droppings were noted. In August, when the channel was largely dry, only a few cow tracks were observed. Aquatic vegetation and algae were rare in April and absent in August. Odor was common in April and abundant in August. Much garbage was observed during both surveys and included a washing machine, mattress, tires, and household trash. The abundant garbage suggests that the site is a common dumping area from the bridge. No human presence or signs of recreation were observed within the reach during either survey.



Figure 8.5 Photograph of Campbells Creek Site 99915 taken on August 12, 2010, showing trash near the 30-m transect. BRA personnel in photograph.

Physical Description of 16395

Campbells Creek at Site 16935 was visited on April 9 and August 12, 2010. The surveys began on the upstream side of Old Hearne Road about 75 m downstream of SH 6 / US 190. Public access is restricted by private property fencing at SH 6/US 190 and at Old Hearne Road. Most of the 300-m reach was accessible only via private land. These obstacles notwithstanding, access was moderately difficult during the first survey due to steep banks and moderately easy during the second survey (Table 8.7). The riparian on both shores was generally forest, though the tree line was narrow (generally < 10 m), and the stream corridor was principally pasture and cultivated land. Figures 8.6 and 8.7 depict the appearance of the site during each of the surveys.



Figure 8.6 Photograph of Campbells Creek Site 16395 taken on April 9, 2010, the downstream view of the 150-m transect.



Figure 8.7 Photograph of Campbells Creek Site 20385 taken on April 9, 2010, the upstream view of the 150-m transect.

Despite drier conditions in August than in April, the average thalweg depth of Site 16395 was steady: 0.35 m during the first survey and 0.37 m during the second survey. Typical average width was also stable, estimated at 4.0 m for both surveys. Significant pools were present during both surveys (Tables 8.14 and 8.15). The 300-m reach was wadeable, although fencing, some rip rap, and a culvert associated with a temporary gravel construction road posed a minor obstacle to traversing the channel. The temporary gravel construction road was in place as work was being performed on the SH 6 bridge during the first survey in April.

Table 8.14 Pools encountered at Site 16395 during survey on April 9, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	66	6.0	1.0
Pool 2	54	5.0	0.49
Pool 3	46	6.0	0.64
Pool 4	110	6.0	0.73

Table 8.15 Pools encountered at Site 16395 during survey on August 12, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	57	3.0	0.90
Pool 2	24	4.0	0.45
Pool 3	41	4.0	0.70

Aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 8.10 and 8.11. Swallows were observed nesting under the bridge in April, otherwise, evidence of animals was restricted to tracks and fecal droppings. Aquatic vegetation was rare and algae was absent during the first survey. Both were rare during the second survey. Water color was brown and odor was rare during both surveys. Some scum was noted in August when flow had diminished nearly to zero. Large garbage in channel was common to abundant and included cans, bottles, tires, and a bike. No human presence or signs of recreation were observed within the reach during either survey.

Physical Description of 20561

Campbells Creek at Site 20561 was visited on May 21 and August 31, 2010. Located southeast of Hearne, Texas, in Robertson County, this site was accessible from the right-of-way at the Jack Rabbit Lane crossing. The site, entirely within private property with a posted no trespassing sign, is located in a pasture dominated corridor with trees and shrubs in the immediate vicinity of the stream channel (Table 8.6). Stream access was moderately easy despite some fencing at the road crossing and occasionally steep banks. Figures 8.8 and 8.9 show the general appearance of the stream during the two surveys.



Figure 8.8 Photograph of Campbells Creek Site 20561 taken on May 21, 2010, the upstream view of the 150-m transect. BRA personnel in photograph.



Figure 8.9 Photograph of Campbells Creek Site 20561 taken on August 31, 2010, the upstream view of the 150-m transect.

Site 20561 was wadeable for the entire 300-m reach although fencing at the road crossing posed an obstacle to traversing the channel. Only one significant pool was present and it was 10 m in length, 2 m wide, and 0.75 m deep. The average thalweg depth range was 0.25 m during the first survey and 0.12 m during the second survey when most of the channel was dry and only shallow, disconnected pools were present (Tables 8.8). The maximum and minimum widths of the stream were 2.3 m and 0.7 m, respectively, during the first survey and 0.5 m and 0.0 m (dry) during the second survey.

The aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 8.10 and 8.11, respectively. Cows were observed during the first survey along with tracks and fecal deposits. During the second survey, only tracks were observed, presumably because there was so little water for the cows to access. Aquatic vegetation was rare in May and absent in August. Algae was rare during both surveys. Odor was absent during the first survey but abundant in August, probably due to stagnating pools. Water color was brown to black during both surveys (Figure 8.10) and scum was present in August on the stagnant pools. Fine sediments dominated the substrate during both surveys. Garbage was common to abundant and included tires, batteries, and household trash indicating that the site was commonly used as a dumping area. No indications of human presence were otherwise found.



Figure 8.10 Photograph of Campbells Creek Site 20561 taken on August 31, 2010, the downstream view of the 300-m transect.

Physical Description of 99916

Campbells Creek at Site 99916 was visited on June 23 and August 24, 2010. Located east of Hearne, Texas, in Robertson County, the site was accessible from a private road about one mile

west of Old San Antonio Road south of Castenson Road. In addition to being entirely on fenced private property with a no trespassing sign, access to the banks was deemed moderately difficult on account of steep banks and dense trees and brush that lined the riparian zone (Table 8.7 and Figure 8.11). Figures 8.11 and 8.12 depict the general appearance of the site during the June and August surveys.



Figure 8.11 Photograph of Campbells Creek Site 99916 taken on June 23, 2010, the downstream view of the 150-m transect.

Flow during the first survey was sluggish but normal for the site in June. In August flow was almost unmeasurable. The site was wadeable for the full 300 m with an average depth of 0.21 m in June and 0.30 m in August. Significant pools were only present in June (Table 8.16). The typical average width of the site during the first survey was 2.0 m and 1.0 m during the second survey. Tree limbs and snags were a major obstruction in the stream channel at some locations (Figure 8.13).



Figure 8.12 Photograph of Campbells Creek Site 99916 taken on August 24, 2010, the upstream view of the 30-m transect.

Table 8.16 Pools encountered at Site 99916 during survey on June 23, 2010.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	16	2.0	0.68
Pool 2	10	1.0	0.70
Pool 3	25	3.5	0.55
Pool 4	10	3.0	0.61
Pool 5	11	4.0	1.0
Pool 6	10	3.0	0.70



Figure 8.13 Photograph of Campbells Creek Site 99916 taken on August 24, 2010, showing snag obstruction downstream of the 150-m transect. BRA personnel in photograph.

Aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 8.10 and 8.11. In June, many hogs, hog wallows, tracks and fecal droppings were observed along with livestock and a few other wild animals. In August, the only evidence of animals was tracks. Aquatic vegetation was absent and algae cover was rare during both surveys. No odor was noted in June but odor was common in August. Fine sediments were the dominant substrate and the water was clear during both surveys but leaf litter debris was present on the surface in June and scum was present in August over most of the reach. Trash was rare in June but large garbage was common in August and consisted primarily of tires. No human presence or signs of recreation were observed within the reach during either survey.

Physical Description of 99917

Campbells Creek at Site 99917 was visited on August 09 and August 24, 2010. Located southeast of Hearne, Texas, in Robertson County, this site was only accessible from a private road west of Old San Antonio Road north of Castenson Road. The reach is entirely on private land in a cow pasture, and the shallow depression in the land that represents the channel carries flow into a stock pond only during rain. The lower half of the reach is represented by the stock pond. No fences inhibit access to the channel because it is in the middle of a field but access to the private property is restricted by fencing. Figures 8.14 and 8.15 depict the appearance of the site during each of the surveys.

Water was never present except in the stock pond at the downstream end of the reach. No measurements of width and depth for transects or pools were taken as the stream corridor was dry.

The aesthetic appearance of the water and wildlife observations for the site during each survey are provided in Tables 8.10 and 8.11. The only animals observed during both surveys were livestock (cows) and their presence was moderate to abundant (Figure 8.16). Aquatic vegetation and algae were common to abundant only at the edge of the stock pond. Trash was absent during both surveys. No evidence of recreation was observed within the reach.



Figure 8.14 Photograph of Campbells Creek Site 99917 taken on August 9, 2010, the downstream view of the 150-m transect showing the stock pond.



Figure 8.15 Photograph of Campbells Creek Site 99917 taken on August 24, 2010, the upstream view at the 150-m transect. BRA personnel in photograph.



Figure 8.16 Photograph of Campbells Creek Site 99917 taken on August 24, 2010, the downstream view near the 150-m transect.

Observations and Interviews

Activities Observed

During each RUAA survey, field personnel visited the sites during times of days and on days when recreational activities were likely to be observed. Three of the five selected sites were at locations that provided public access via road crossings, but these publically accessible sites were situated largely on private property. The uppermost two sites were located entirely on private land and only accessible by driving on private roads inside fenced and gated property with landowner permission. Fencing at the right-of-ways of the publicly accessible sites was a minor obstacle to stream access. Dense brush, steep banks, and log jams in the stream channel were more formidable obstacles to wading at Sites 99915 and 99916.

No contact (primary or secondary) or noncontact recreational activities were observed by RUAA field personnel at any of the sites during the surveys nor was evidence found of possible recreation. While conducting the stream surveys, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds or sports fields, were encountered that would promote recreation.

Activities Interviewed

An interview was conducted with one landowner on upper Campbells Creek. The landowner said he was unaware of any recreation of any kind on Campbells Creek due to the shallowness of the creek. The recreational activity reported by the one interviewee is summarized in Table 8.17.

Table 8.17 Summary of recreational activities noted in interviews for Campbells Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location. No recreational activities were observed during field surveys or site visits.

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunting	Fishing	Boating, Canoeing, Kayaking
99915							
16395							
20561							
99916	1	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
99917							
Totals	1	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0

Summary

RUAA surveys were conducted at five sites along Campbells Creek (1242I) on the days of April 9, May 21, June 23, August 9, 2010 for the first survey and on August 12, 24, and 31, 2010 for the second survey. The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions during surveys as conducted between April and August 2010 (NCDC, 2014). The average thalweg depth across the two surveys was 0.22 meters and while several pools were encountered, none were greater than one meter deep.

Areas of the stream open to the public are limited to the right-of-way areas immediately underneath the bridge crossings in the lower portion of the watershed. At these road crossings, fences present obstacles to accessing private property along the stream corridor. In the upper portion of the watershed, access to Campbells Creek is limited to private property that is fenced, gated, and locked.

During the two surveys, there were no contact recreational activities observed by field personnel. Additionally, there were no noncontact recreational activities observed during either survey. Water levels in the creek were quite low or nonexistent during both surveys. The single interview conducted with a landowner in the upper watershed indicated no past or present recreation. According to the lone interviewee, a landowner near Site 99916, there is typically insufficient water recreation to occur.

A recreational activity map is not provided for Campbells Creek as no forms of recreation were observed or noted in interviews for this water body.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Campbells Creek

Segment No. of Nearest Downstream Segment No.: Segment 1242

Classified: Intermittent (unclassified water body)

County: Robertson

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

b. Do secondary contact recreation 1 activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

c. Do secondary contact recreation 2 activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

d. Do noncontact recreation activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

2. Physical Characteristics of Water Body

a. What is the average thalweg depth? 0.22 meters

b. Are there substantial pools deeper than 1 meter? ☐ Yes ☒ No

c. What is the general level of public access?

☐ easy ☐ moderate ☒ very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

☐ Mild-Extreme Drought

☐ Incipient dry spell

☐ Near Normal

☐ Incipient wet spell

☒ Mild-Extreme Wet

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